N 21 '21

The Heating and Ventilating Magazine

A MONTHLY JOURNAL OF ENGINEERING PROGRESS

Vol XVIII. No. 11 — NOVEMBER, 1921 — New York Office, 1123 Broadway

$2.00 a year 20 cents a copy — Published at Cooperstown, N. Y.

Scale and Dirt Won't Clog

RADIATOR TRAP SARCO

When you wish to operate as a gravity system to remove scale and dirt from a new job, simply unscrew the cap of a Sarco Radiator Trap and you can lift out the element in a jiffy. After the system has been washed out, drop in the element again and its adjustment will not be affected. Isn't that a worth while advantage?

No scale can collect on the seat of a Sarco because line contact only is had between the seat and the bronze metal ball in the valve head, which is held in a socket.

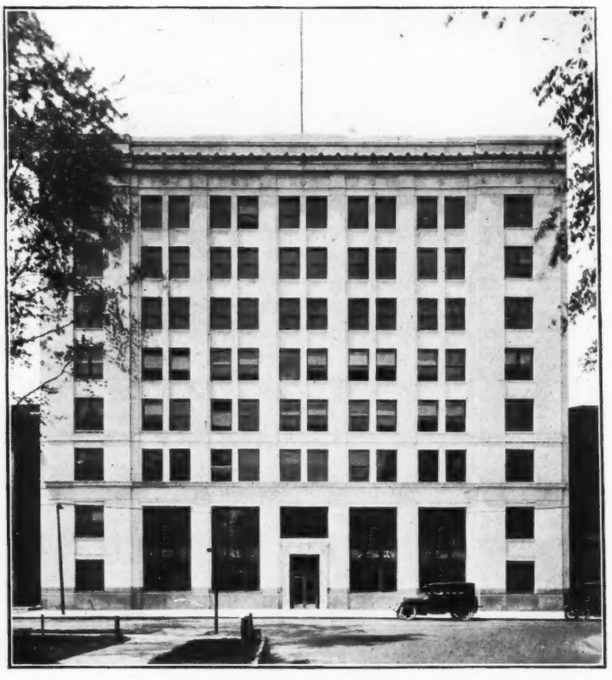
Further protection is given by the loose internal screen which is accurately fitted and has a mesh area ten times that of the valve seat.

This noiseless, factory-adjusted trap can be installed with the absolute assurance that it will operate *right* without any adjustment. And it will outwear ordinary traps due to the spiral corrugations in the diaphragm and the substantial construction of all parts. Made for vacuum, vapor and steam heating systems up to 20 lbs. pressure. Send for Booklet P-100.

SARCO CO., INC.

231 Broadway, New York

Buffalo Chicago Cleveland Detroit Philadelphia



STANDARD ACCIDENT INSURANCE CO. BLDG. DETROIT, MICHIGAN

Architect—Albert Kahn, Detroit, Michigan
Heating & Vent. Contractors Johnson, Larsen & Co., Detroit, Michigan

CLARAGE
KALAMAZOO

MULTIBLADE FANS INSTALLED IN THIS OFFICE BUILDING

MANY times Clarage Kalamazoo Multiblade Fans are chosen not only because of their large capacity, low speed and economy of operation, but because, above everything else, this equipment is dependable.

These fans are so built and so constructed that they will render years of faithful service, without the necessity for any repairs. Hundreds of installations in all types of public buildings and in industrial plants bear evidence that Clarage Fans *are dependable*.

A complete Clarage Multiblade Fan System for heating, ventilating and humidifying is now operating in the new Standard Accident Insurance Co. building in Detroit.

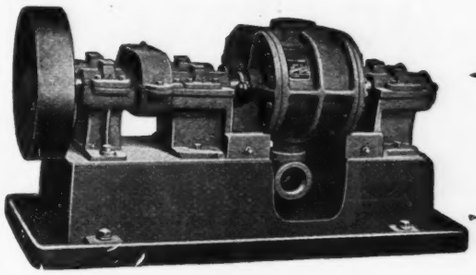
Our Engineering Department will gladly place before you all the data and statistics we have compiled. Allow us to send you Catalog No. 52.

CLARAGE FAN COMPANY

Branch Offices in Principal Cities

HOME OFFICE & WORKS at KALAMAZOO, MICHIGAN

Economy



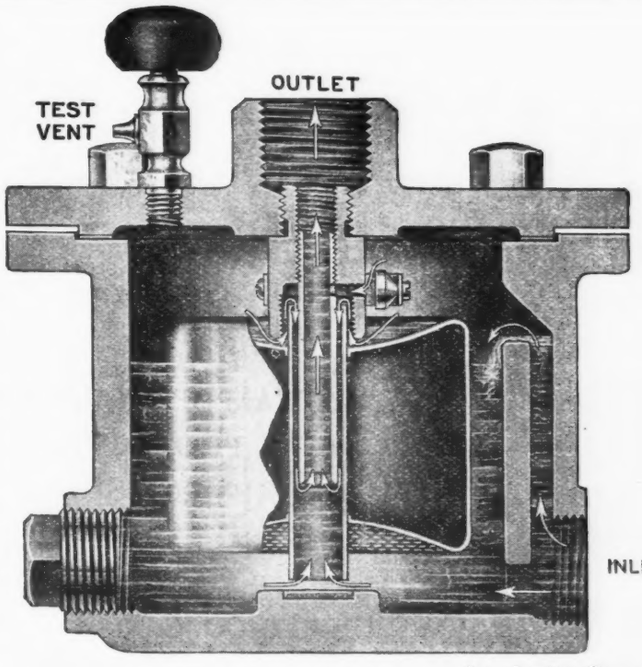
Service

Economy in a vacuum heating system is determined to a greater extent by service than by first cost. Users of Connersville Vacuum Pumps have found that with little attention they continue to run year after year, giving the same dependable service, each succeeding season.

The Connersville Blower Company

—— Connersville Indiana U·S·A· ——

Chicago, Monadnock Block New York, 114 Liberty Street



MARSH

DUPLEX WATER SEAL LOW PRESSURE

BLAST TRAP

FOR DIRECT OR INDIRECT COILS OR ANY LOCATION WHERE LARGE QUANTITIES OF WATER ARE TO BE DISCHARGED

Operates automatically either with or without mechanical suction on return line.

No complicated parts to stick or get out of order.

No small openings to clog up with sediment or scale.

Free passage of water—rapid and steady vent of air and passes no steam.

Combined action of flotation for water and all metal thermostatic vent for air together with relief of air through water seal makes the ideal trap for heavy service.

Adjusted and tested at factory and shipped ready for installation, to work automatically from below atmosphere on up to 25 pounds steam pressure.

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Manufacturers of Radiator Traps and Specialties—Automatic Air Valves and Vents
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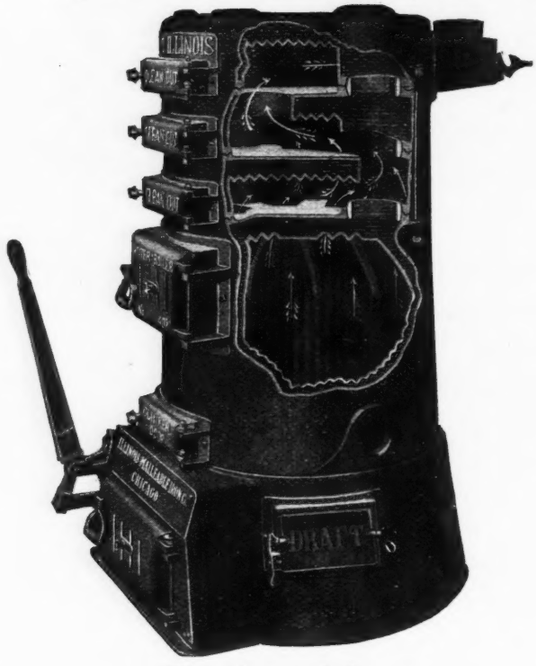
IMICO HEATING BOILERS

For Water and Steam

Various Sizes



Imico Vacuum Heating System

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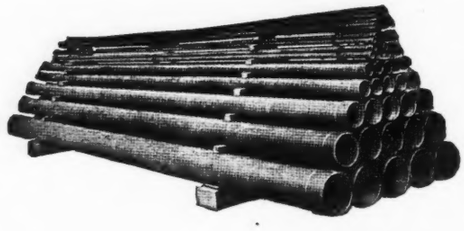

STEAM SPECIALTIES
FIRE PROTECTION EQUIPMENT
FIRING TOOLS

Sole Distributors for this section of WM. POWELL CO.'S
HIGH GRADE VALVES and DEPENDABLE ENGINEERING SPECIALTIES

PIPE COILS and BENDS — PLUMBING SUPPLIES

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STEEL Boilers

Thirty-five years ago we began making Kewanee Firebox Boilers of ***steel*** because it was the best material to be had for boiler building. We have never changed from steel and never will until a better material is found. Should the time ever come when the durability of steel is surpassed by some other material Kewanee will be the first to use it for our boilers must head the list of service-giving heating units.

KEWANEE BOILER COMPANY
KEWANEE, ILLINOIS

BRANCHES:
Steel Heating Boilers, Radiators, Tanks, Water Heating Garbage Burners

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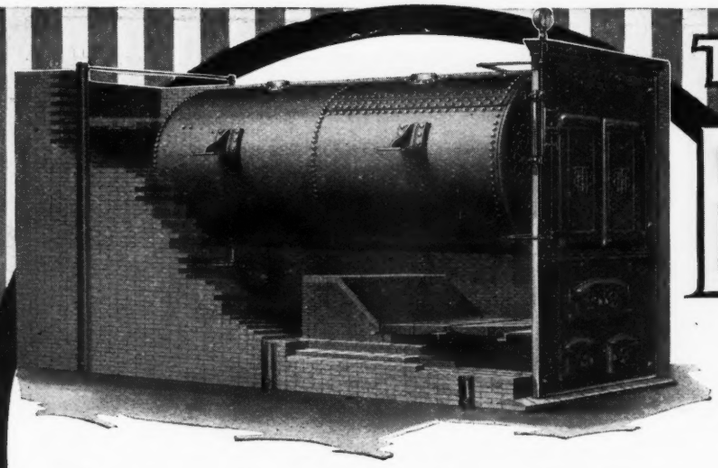
CANADIAN REPRESENTATIVES—The Dominion Radiator Co., Ltd.
Toronto, Ont., Montreal, Que., Winnipeg, Man., Hamilton, Ont., St. John, N. B., Calgary, Alta.



TITUSVILLE BOILERS

TITUSVILLE

Horizontal Tubular Boilers for Steam Heating

All materials, bracings, riveting and details of construction are in exact accordance with the A. S. M. E. Boiler Code.

Designed for a maximum working pressure of fifteen pounds to the square inch.
Subjected to a hydro-static test pressure of sixty pounds before shipment.
Our new catalogue giving complete data and specifications will be gladly sent on request.

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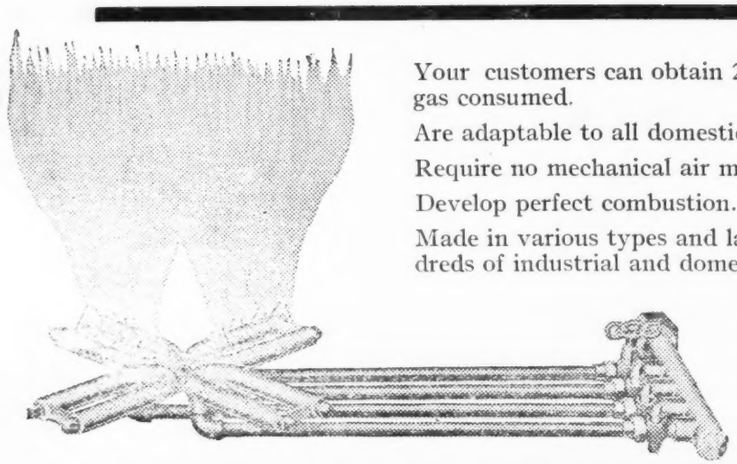
Manufacturers of Heating Appliances and Heating and Plumbing Contractors, Who Are Busy These Days

HAVE ADOPTED

Barber Patented Gas Burners



Your customers can obtain 25% to 40% more heat from the gas consumed.

Are adaptable to all domestic heating appliances.

Require no mechanical air mixers.

Develop perfect combustion.

Made in various types and layouts to specifically handle hundreds of industrial and domestic heating problems.

Can be quickly installed or removed from any appliance in a few moments if the gas pressure is entirely shut off.

Write Us for Our New Catalog Showing Complete Line and New Attractive Prices

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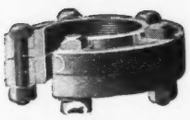
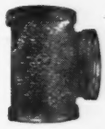
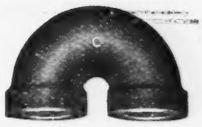
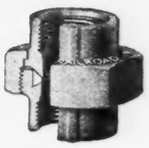
3702-04 Superior Avenue, Cleveland, Ohio



Suggestions for Factory Heating

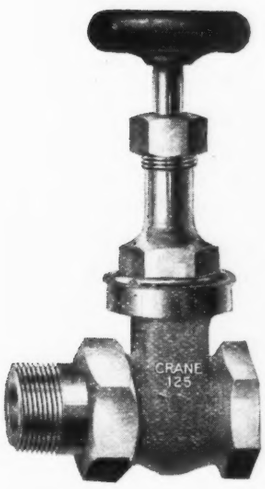


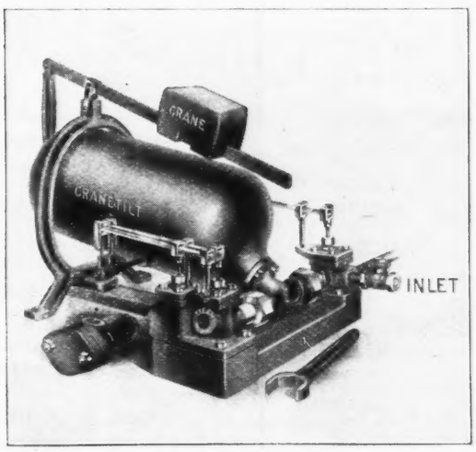
The heating apparatus of the modern factory is of prime importance. To produce the best results with reasonable economy requires the use of high-grade equipment. The

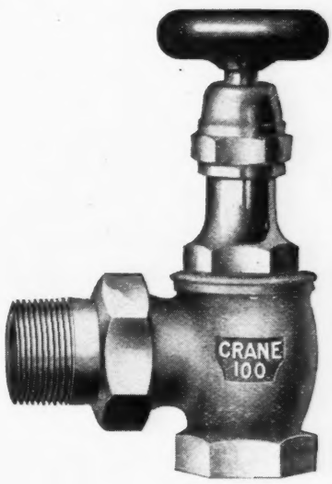
CRANE

line of products for heating is complete, and meets all requirements according to the best modern practice.

We are manufacturers of about 20,000 articles, including valves, pipe fittings and steam specialties, made of brass, iron, ferrosteel, cast steel and forged steel, in all sizes, for all pressures and all purposes and are distributors of pipe, heating and plumbing materials.







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SPENCER Magazine Feed HEATERS

Turn your Customer's desire for lower coal bills into sales

Your customer building a home or installing a new heater wants one that will keep his coal bills as low as possible.

The Spencer Magazine Feed Heater burns small size—No. 1 Buckwheat—coal which costs about a third less than large size coal.

It requires attention only once in 12 hours—longer periods in moderate weather

Complete service is maintained through representatives in New York, Boston, Philadelphia, Baltimore, Buffalo, Detroit and Chicago.

Successfully Burns No. 1 Buckwheat

STANDARD HEATER COMPANY
Williamsport, Pa.

Positive Heat Control
SAVES 20% to 30% on FUEL Bills

You save expensive air valves, traps and other devices when you install ADSCO HEATING. The ADSCO Graduated Radiator Valve with the ADSCO Regulator enables you to use a system of piping that saves labor as well as material.

You can change over hot water systems or other vapor systems. Saves 20% to 30% fuel cost.

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Ask about Adsco Heating of building groups from Central Station Steam Plant—Bulletin 20-H; for individual buildings, Bulletin 150-H.

Adsco Damper Regulator

ADSCO HEATING

Adsco Graduated Radiator Valve

"Figures don't lie"

Now that you have figured how much you can save by installing ECONOMY BOILERS; and how much it would cost to install the kind of boilers that require expensive pipe headers to insure dry steam; you surely realize the advantage of installing "*the boiler without a header.*"

Don't the figures prove conclusively that the Economy is a good boiler to tie to?

When your customers lay down their good money for a boiler they want a modern heater.

Then why not specify and install the Economy?

Send us your order. We're making prompt shipments from Utica and all branches.

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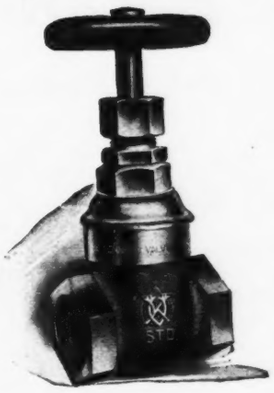
KENNEDY VALVES

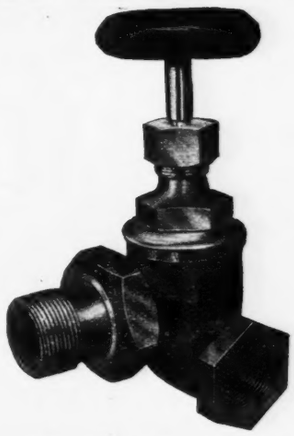


The Test of Valve Quality

is the length of time the valve continues to render the most efficient service without giving trouble or entailing expense. There are Kennedy Valves of the long time kind all over the United States and Canada.

These Kennedys are doing good work in every variety of valve service, and a considerable proportion of them are on high and low pressure heating system lines.

The experience of thousands of users of Kennedy Valves have given the Kennedy product a reputation for durability, reliability, and efficiency of which we are justifiably proud and that we conscientiously strive to maintain.



You can be sure that every Kennedy Valve you install will be *permanently* satisfactory in every way. The Kennedy Catalog explains the details of design and construction that assure easy operation, low repair cost, negligible attendance and unusual durability. Send for a copy and use it to help make a selection of Kennedy Valves for trial.

250

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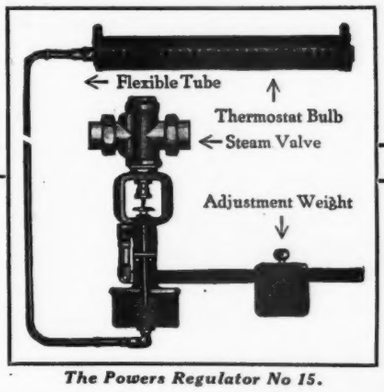
Economical Heat---



The Powers Regulator No 15.

The Powers Regulator enables you to have an even temperature at all times. Especially economical on processes where overheating or underheating is liable to cause great damage.

The Powers Regulator is always on the job—never resting—never forgetting to turn the valve—never too busy—never shirking its duty. It lives up to its name—regulating and controlling heat.

Manual temperature control is never accurate and always expensive—counting wages and mistakes, both of which are eliminated by the Powers Regulator.

Men can be depended upon to a certain extent. But the Powers Regulator can **always** be depended upon.

Built on scientific principles, it is entirely automatic. Once adjusted to a certain degree, just that much heat and no more or less will be used. It **really controls.**

THE POWERS REGULATOR CO

Specialists in Automatic Heat Control

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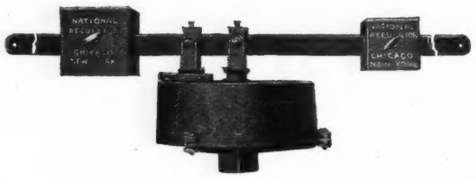
The Canadian Powers Regulator Co., Ltd., Toronto, Ont.

1577 B

HOT WATER

LOW PRESSURE

2" for Hot Water



7" for Low Pressure and Vapor

Made in 2", 4", 7" and 10" sizes

Metaphram Damper Regulators

For Low Pressure and Hot Water Boilers

also

Metaphram Regulators

For Hot water Tanks, Ovens, Pots, Driers, Refrigeration and other industrial processes.

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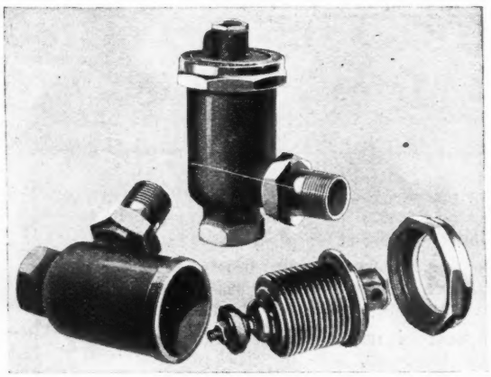
VAPOR

A-JACKS for HIGH PRESSURE



B & B Pneumatic Valve

When it comes to Heating, specify the B. & B. Heating Specialties and B. & B. Temperature Control System. You will find the B. & B. Specialties will always give you the best of service—for service means—DURABILITY—SIMPLICITY—and the sectional cuts illustrated show these features; which means that your repair bills are going to be eliminated. We refer you to such buildings as the

DURANT BUILDING, DETROIT, MICHIGAN—Temp. Control and Vacu Traps:

HANNA BUILDING, CLEVELAND, OHIO—Multiflex Traps:

PENNSYLVANIA HOTEL, NEW YORK, N. Y.—Temp. Control:

and thousands of similar buildings.

Literature sent upon request

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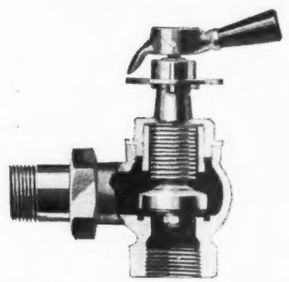
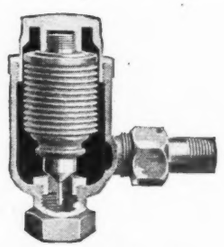
The B & B Line

QUALITY SERVICE

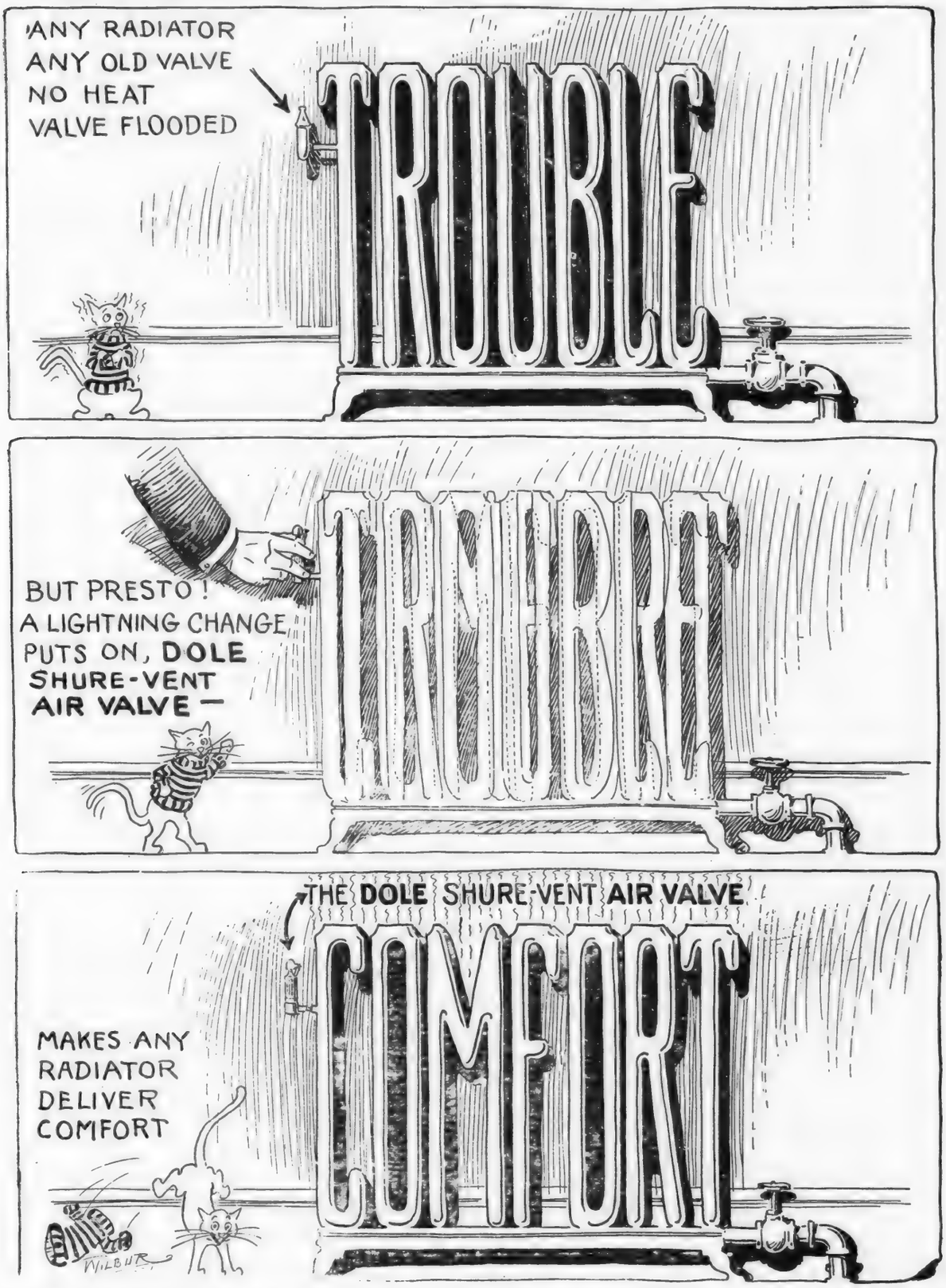


B & B Multiflex Modulation Valve



B & B Multiflex Trap

THE METAMORPHOSIS OF A RADIATOR



FREE SAMPLE

We want every practical heating engineer and contractor to test this valve and will furnish one valve free upon request.

The Dole Valve Co.

Makers of Dole Packless Radiator Valves
Dole Shure-Vent Air Valves

1923-1933 Carroll Ave. Chicago, Ill.

GUARANTEE

Should any Dole Shure-Vent Air Valve fail to vent properly during the life of the plant, a new valve will be furnished without question or charge.

Leakless.

Approved by the trade.

Valued by those who know.

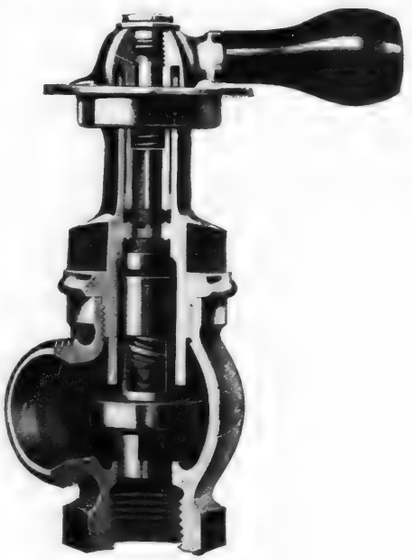
Inexpensive on a basis of results.

Graduated and packless.

Not a "competition" valve.

Efficient in service.

QUICK-OPENING RADIATOR VALVES



Sectional View
Lavigne
Graduated Packless Valve

BUILT RIGHT—TO STAY TIGHT

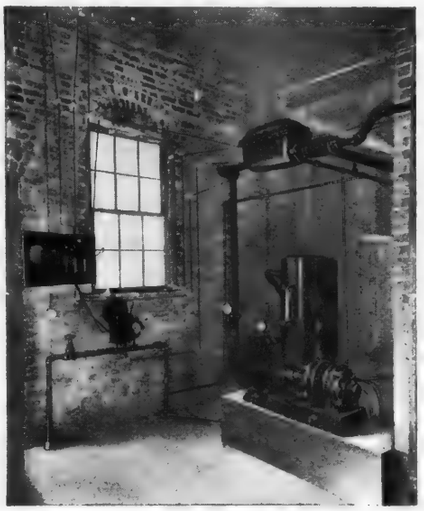
Made in six sizes, many styles of handles

All good jobbers handle them

COMMONWEALTH BRASS CORPORATION

Detroit, Mich.

KALAMAZOO VACUUM PUMP



For the Heating Plant
Returns all Condensation to Boiler

We can feed boilers at from 0% to 100% pressure as specified.

We can maintain the vacuum within four inches variation.

We can maintain the Boiler Water level within three inches when electricity is cut off.

In cool weather the motor runs a small part of the time, reducing the electric bill.

In very cold weather it runs nearly constant.

The vacuum control limits the vacuum and is set for a maximum.

The pump is hydraulically balanced and there is no end thrust.

The thrust collar acts as an oil collar only.

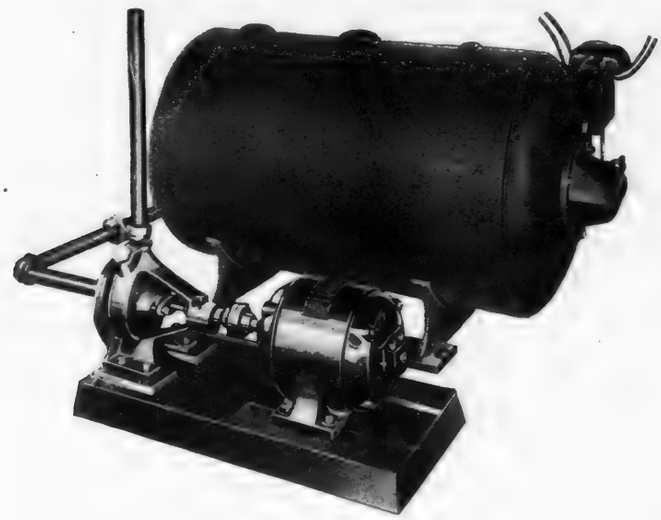
Built under the following Patents:
Sept. 4, 1917, May 24, 1921. Other Patents pending

MANUFACTURED BY
CLARK ENGINE & BOILER CO.
KALAMAZOO, MICHIGAN

Let us have your specifications for a finished quotation

WRITE FOR
BULLETIN HV-100

Dependable Service



Trane Pumps are backed by a record of results, a proven performance under widely varying conditions. Simple, sturdy in construction, their distinct characteristic of operation against high pressures particularly fits them for a wide range of heating needs. Whether your requirements are for a Condensation, Vacuum, or Return Line Pump, there is a Trane Pump to meet your needs and to give you the same dependable service they are giving others.

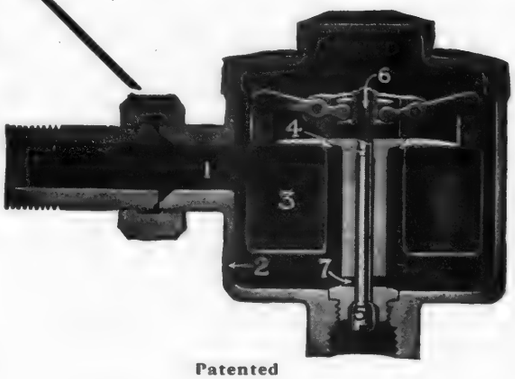
Bulletin No. 2, listing Trane Condensation Pumps, is specially arranged to make it easy for you to select just the right size Pump to meet any given requirements. Write for your copy and discounts today.

The Trane Company, 206 Cameron Ave., La Crosse, Wis.

Chicago New York Boston Philadelphia Washington, D. C. Cleveland Buffalo Salt Lake City Portland, Ore.

TRANE PUMPS

A Steam Trap that Automatically Eliminates Air and Water Condensation Without Allowing Escape of Steam



Patented

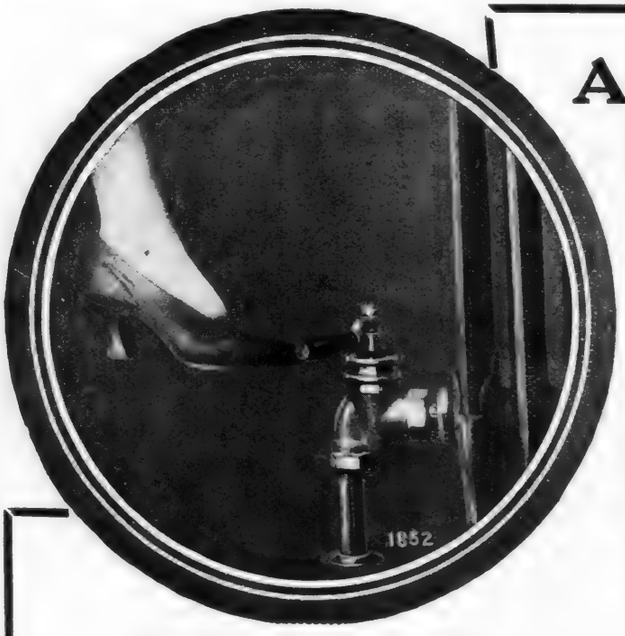
THE McDonald Under-Seat Valve is the only valve of its kind on the market. The principle of operation is positive and noiseless. It gives perfect service on any radiator on a two-pipe heating system and under any ordinary pressure up to ten pounds. Handles and discharges a much larger quantity of water than any other trap or valve of equal size. Self-cleaning. Carries away all scale. Entire inside instantly removable by loosening cap. Saves every ounce of steam. Its economical features are greatly appreciated by the building owner.

Leading architects, heating engineers and contractors are specifying and installing large numbers of the McDonald Under-Seat Valve, because its superior features have been proven in service.

Write for detailed information

The McDonald Under Seat Valve Co.

602 Swetland Building **CLEVELAND, OHIO**



No stooping—the slightest touch of the foot operates the valve

A Quarter Turn of the handle opens or closes the GORTON QUARTER-TURN VALVE

It is the easiest operating valve in the world, and users will regulate heat in a room by opening and closing the radiators, saving steam.

With the old time valve requiring five or six turns of the wheel to open or close the valve users open the windows to cool a room, an immense waste of steam.

Wasted steam is wasted coal.

Equip your radiators with GORTON Valves and save money on your Coal Pile.

Write for Catalogue

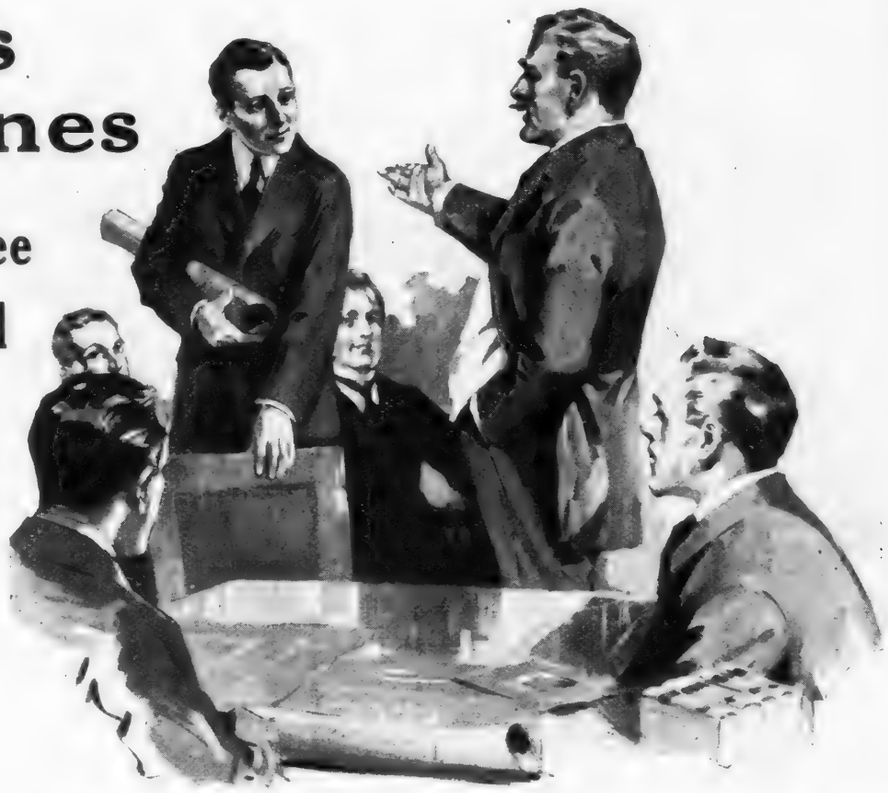
Gorton & Lidgerwood Co.

Fisher Bldg., Chicago, Ill. **100 Liberty St., New York, N. Y.**

See Sweet's Architectural Catalogue, Page 1757, for Specifications

"Yes Mr. Jones

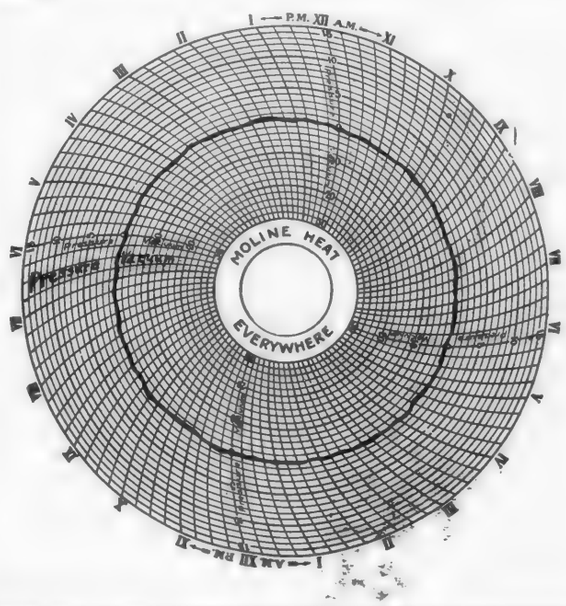
Our Committee Has Decided to Award the Heating Contract to You."



"Although your bid was not the lowest in price, in our opinion, you submitted the best proposal."

"We have selected your Moline Heat proposition principally because of its simplicity, because no automatic radiator traps or vacuum pumps are necessary to maintain circulation and yet you can circulate steam through all radiators with only a few ounces of pressure.

"Mr. Jones, that means economy in maintenance —the highest efficiency—and that's what we are after."



Yes, Mr. Progressive Heating Contractor, these are pleasant moments. How sweet the words, "the contract is yours, although your price was not the lowest."

Do you know that there are many of your customers who are willing to pay you more—when you can convince them that you have something better. You can convince them with Moline Heat.

There are many Moline Heat installations, with 500 and more radiators and hundreds of thousands of square feet of radiation in use without a single automatic or thermostatic trap on the radiators—no vacuum pumps required and yet every radiator and coil heats through with practically no pressure.

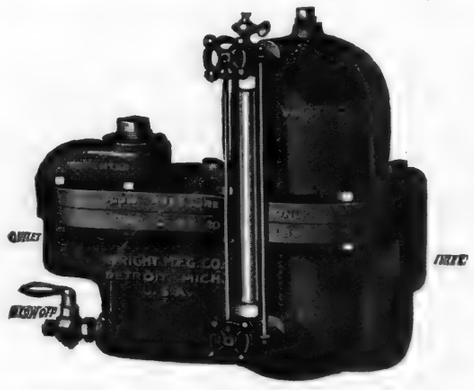
Is this not sufficient reason for the selection of Moline Heat by experienced owners? They know that it means less trouble, less maintenance expense and far better operation.

When you figure your next job for a factory, school, apartment, residence, or any other building, send us a set of the building plans, and then submit your proposal on Moline Heat and

SEE WHAT HAPPENS---

If you haven't our catalogs, write for them today. Write Dept. F.

Moline Illinois



Four dominant features of the Wright "Victor" Steam Trap are:

1—One large, special valve which handles floods of condensation or small amounts, automatically and continuously.

2—Operates perfectly under absolutely no pressure or any pressure up to 20 pounds.

3—Has straight line pipe connections through inlet and outlet so working parts can be removed without disturbing the piping.

4—The trap has no intricate parts. Valve is at the top where sediment can't reach it.

Continuous Discharge Features Wright "Victor" Steam Trap

Designed, constructed and guaranteed to drain automatically and continuously all accumulated condensation from heating systems—regardless of small flows or floods of water—the Wright "Victor" Low Pressure Steam Trap does not waste steam under any conditions. Continuous discharge is a dominating feature of the "Victor" Trap.

Through one extremely large valve the "Victor" discharges large or small quantities of condensation under absolutely no steam pressure and up to 20 pounds.

The discharge is continuous because incoming condensation alone is sufficient to lift the valve of the trap.

In various lines of industry the "Victor" Trap has increased production—raised the efficiency of steam heated equipment—lowered fuel cost—by removing all condensation from steam lines continuously.

We will gladly refer you to users of the "Victor" Low Pressure Trap located in your locality, that you may obtain complete information regarding the operation of the trap.

WA Standard with STEAM USERS SINCE '94

WRIGHT-AUSTIN COMPANY

DETROIT, U. S. A.

Branch Offices: New York, Chicago, Boston.
Export office: 30 Church St., New York City.

Representatives Everywhere.

Webster

Systems of Steam Heating

The Webster Systems of Steam Heating are providing economical warmth in thousands of public, semi-public and private buildings of every size and type throughout the country. Thirty-three years of leadership in steam heating system improvements have made Webster equipment the recognized standard today.

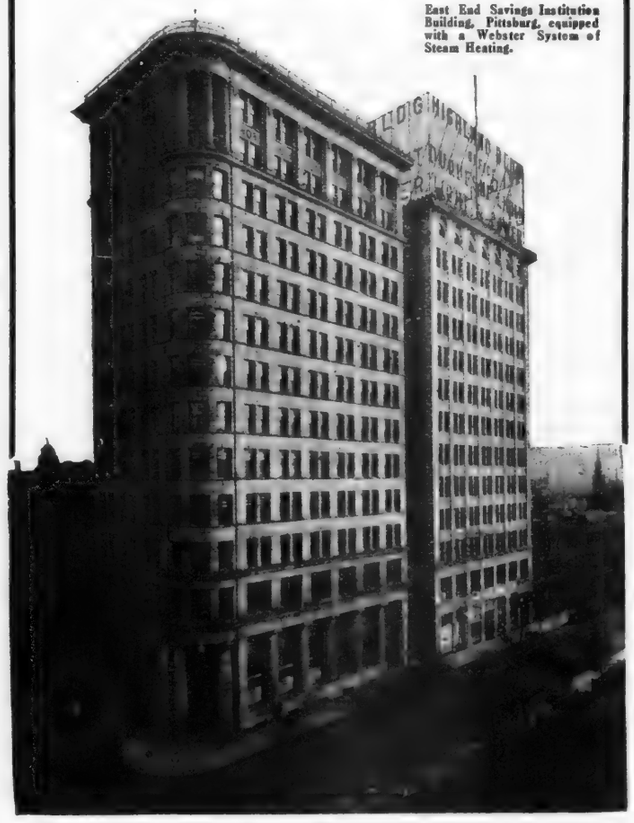
The success of each Webster installation is assured by the hearty and thorough cooperation of the Webster engineers as well as by the excellence of Webster apparatus. This cooperation is offered through the 31 Webster Branch Offices and Service Stations and includes a consultation service to architects, engineers and contractors in planning a suitable heating system for buildings of every type.

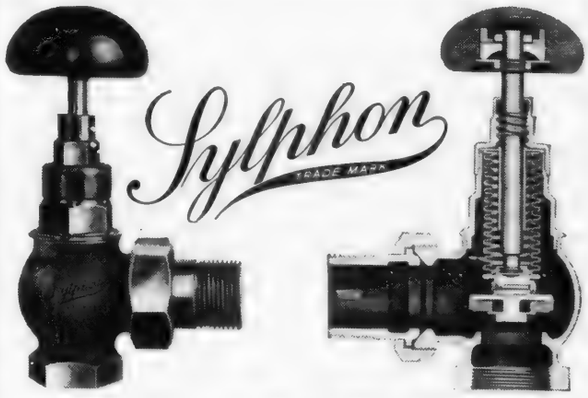
Write for Bulletin

WARREN WEBSTER & COMPANY
Camden N. J.

BRANCHES IN 31 CITIES 143

East End Savings Institution Building, Pittsburg, equipped with a Webster System of Steam Heating.





The Sylphon Leakless Radiator Valve is suitable for steam, hot water or vacuum heating systems. It is exceptionally well shaped and beautifully finished. The distinctive round-top, rosewood finish handle prevents burning of the hands and has no depression to collect dirt and dust. Furnished in angle, corner, globe, lock and shield, and other special types.

Note the unbroken metal barrier between the steam or hot water and the stem of the valve. This is accomplished by means of the patented "Sylphon" drawn metal bellows which expands or contracts as the stem is screwed in or out. There can be no rusting of the stem and leakage is impossible.

Sylphon Leakless Radiator Valves

may now be obtained direct from the manufacturer. *Prices reduced.*

OUR new policy of distributing these valves means lower prices to the trade and jobber. You can now supply your customers with these superior valves at prices no higher than less efficient valves of the same type—and with equal profit to yourself.

The market for Sylphon Leakless Radiator Valves is firmly established. They are used on many of the finest heating installations in the country. If you are not familiar with their mechanical details, examine the sectional illustration above. Then fill out the coupon below for full details and our new prices. Address department W.

THE FULTON COMPANY

Knoxville, Tenn.

New York
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The Heart of every Sylphon Product

This is the wonderful Sylphon bellows, invented and patented by W. M. Fulton, and found only in genuine Sylphon instruments. Being made of one continuous piece of drawn metal, it has extreme flexibility combined with the greatest possible strength. There is no solder to leak or crack. The Sylphon will last a lifetime.

THE FULTON COMPANY, Dept. W., Knoxville, Tenn.

Check here, if you wish information on other Sylphon products.

[ ] Temperature Regulators
[ ] Damper Regulators
[ ] Vent Valves
[ ] Pressure Regulators

Please send me full particulars of Sylphon Leakless Radiator Valves, without obligation.

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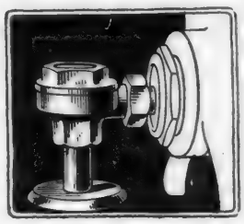
.....(Dept. W)

DUNHAM RADIATOR TRAP



STABILITY

Heating engineers and heating contractors who believe in standardization, in the stability of a good idea—in the use of equipment that will be as good tomorrow as today—will appreciate the significance of the fact that cast iron does not enter into the manufacture of the Dunham Radiator Trap. The metals used are entirely bronze and brass.

The persistency of imitators to *adopt Dunham principles* is the surest evidence of the correctness of our belief that there is not any other trap that is "just as good" as the Dunham.

Dunham Specialties Are Described Fully in SWEET'S INDEX and in MCRAE'S BLUE BOOK

The DUNHAM HEATING SERVICE

REG. TRADE-MARK

Dunham Specialties

Packless Radiator Valves
Radiator Traps
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Blast Traps
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Reducing Pressure Valves
Oil Separators
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Check Dampers
Damper Regulators

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OZONE PURE AIRIFIER

The installation of the "Ozone Pure Airifier" in connection with Fan systems of heating and ventilation in schools, theaters, banks and manufacturing plants, permits of re-circulation of a large percentage of the total air volume handled.

ADVANTAGES

Saving in Cost of Operation

1.—Reduction of 25 to 50% in coal consumption.

2.—Reduction in Steam Consumption.

Saving in initial Cost of Mechanical Equipment.

1.—Tempering coils may be omitted.

2.—Boiler capacity may be reduced.

3.—Sizes of steam and return pipes, valves, fittings and pumps may be reduced.

RESULTS

Pure air in rooms, free from organic odors and impurities.

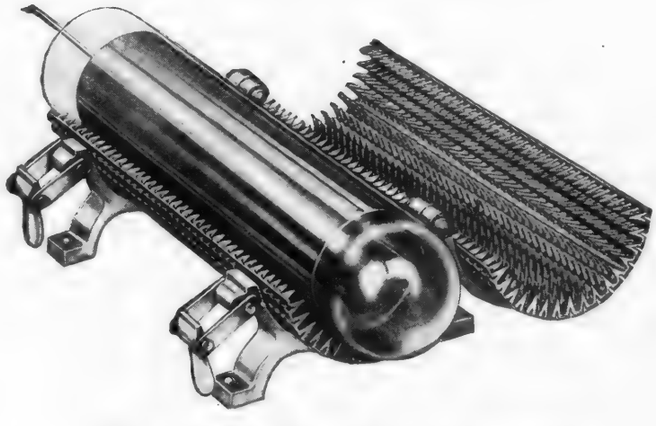
The power consumed by the apparatus is extremely small, being only about 120 watts maximum for a 25,000 cu. ft. (per minute) machine when operating on alternating current. Based on an energy cost of 10c per kw. hr., this would give a cost of 12c per 10-hour day.

We will be pleased to send literature on this subject to anyone interested,

Ozone Pure Airifier Co.

1403 W. Jackson Blvd.

CHICAGO, ILL.



One complete unit capable of properly ozonizing 1000 cu. ft. of air per minute. The unit is shown open to illustrate simplicity of construction and ease of cleaning.

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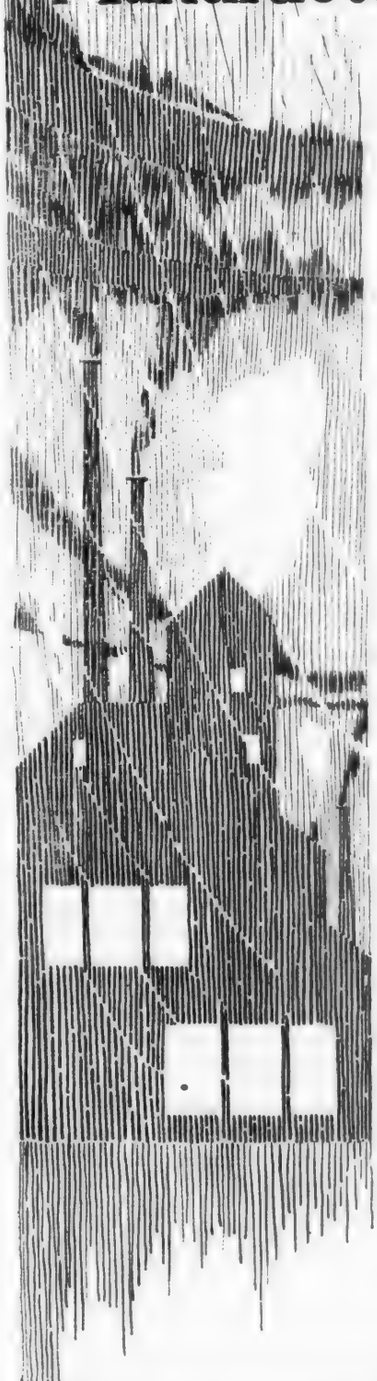
Manufactured to suit your Product



The System
That Made the Guarantee Possible

The System:

The system which enables us absolutely to control the weather conditions inside your plant was developed thru 60 years' work on heating, ventilating and Air Conditioning problems in every industry the world over.

The cumulative advantages gained thru this experience is built into every Sturtevant Air Conditioning Installation. Such experience cannot be purchased, but it goes gratis with every Sturtevant Air Conditioning System installed by our Engineers, W. L. Fleisher & Co.

The Guarantee:

Written in every contract, whether you request it or not, is the following GUARANTEE:

"11. In the event that the installation does not fulfill the operating guarantees, then we shall be given a reasonable opportunity to make such changes at our own expense as we may deem necessary.

"If, after reasonable time has been given to make such alterations, the equipment continues to fail to fulfill the operating guarantees, then we shall refund all moneys paid to us on account of the installation, and shall remove the apparatus from the purchaser's premises at our own expense, thereby terminating this contract, and all liability of either party to the other for damages for any cause whatsoever."

And our installations have been so uniformly successful that we have never had to put this GUARANTEE clause into effect.

B. F. STURTEVANT COMPANY
Hyde Park Boston

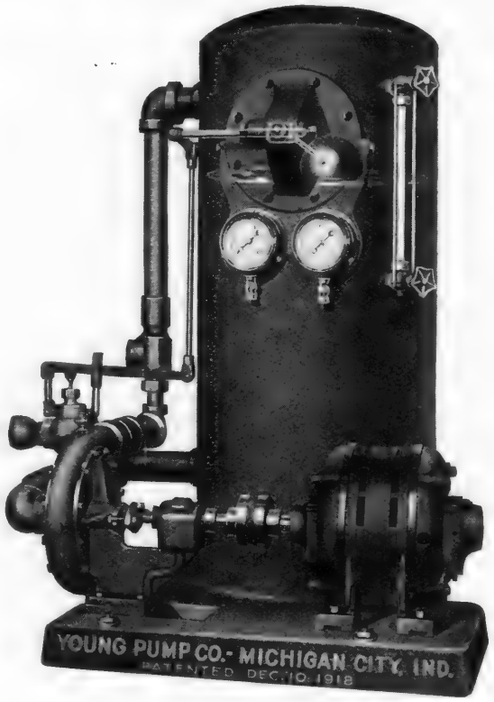
W. L. FLEISHER & CO., Inc.
New York City
Design and Install All Sturtevant-Fleisher Air Conditioning Systems

Sturtevant
PUTS AIR TO WORK

Young Centrifugal Vacuum and Boiler Feed Outfits

Consists of a centrifugal pump with motor direct connected, tank, exhauster and balanced by-pass valve. The pump, motor and tank are mounted on a substantial cast iron base and the outfit completely assembled as shown in the cut, so that as received on the job it is only necessary to make pipe connections to the system and boiler, wiring connections to the motor, when it is ready for operation.

It is the simplest outfit made. There are no valves, springs or other parts that require adjustment, wear out or cause repair expense; not a feature more complicated or liable to cause trouble than the motor.



Made in six sizes to handle 4,000, 8,000, 16,000, 26,000, 40,000 or 65,000 sq. ft. of radiation; for continuous operation or automatic control, to meet any condition or pressure.

Complete information and prices upon application.

Write for descriptive pamphlet.

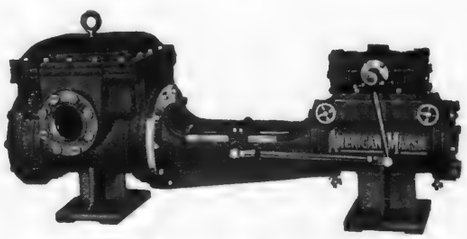
CHICAGO OFFICE

327 S. La Salle St. **Phone Harrison 5920**

American-Marsh Pumps

for Heating Systems

For use in returning the condensation to the boiler on heating systems where the steam pressure is too low to operate a steam pump. Water is returned to the boiler in its hottest state. Equipped with an automatic float valve which is positive and reliable.



The Recognized Standard

American-Marsh Vacuum Pumps have been recommended and specified by a majority of the leading heating engineers and Contractors for over twenty years.

Made with only best of material and workmanship. Highest efficiency guaranteed.

Equipped with an improved steam valve which is especially adapted for vacuum service. American-Marsh Pumps are positive in action, possess a perfect governing element and will not hang up under all the varying conditions.

Ask for Bulletins Nos. 24 and 27

AMERICAN STEAM PUMP CO.

Battle Creek, Mich.

Our slogan: Simplex not Duplex. "To be simple is to be great"

ALLEN AIR-TURBINE VENTILATOR

Standard of Ventilating Efficiency

Wherever ventilation is desired—in factories, foundries, stores, schools, hotels, churches, theatres, residences, kitchens, bakeries, tanneries, barns, stables, garages, chimneys, air shafts, or wherever air circulation is required, Allen Air-Turbines *have proven the best, cheapest and most efficient* ventilating system known.

Many of America's largest architects, engineers and industrial concerns have adopted and endorse Allen Air-Turbine Ventilators.

Patented

Our air displacement is measurable and the figures given are guaranteed to be correct.

Diameter of Pipe	Air Displacement Cu. Ft. per Hour	
	Wind Velocity 4 Miles per Hour	Wind Velocity 8 Miles per Hour
8 Inches	17,300	21,600
10 "	26,500	32,500
12 "	38,600	46,200
15 "	54,000	69,000
18 "	85,200	102,100
20 "	105,100	125,600
24 "	149,000	185,000
30 "	225,000	272,000
48 "	360,000	473,000

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GASES
MOISTURE
STEAM
SMOKE
VAPOR
FOUL AIR
ODORS
HEAT
FUMES
DUST
DAMPNESS

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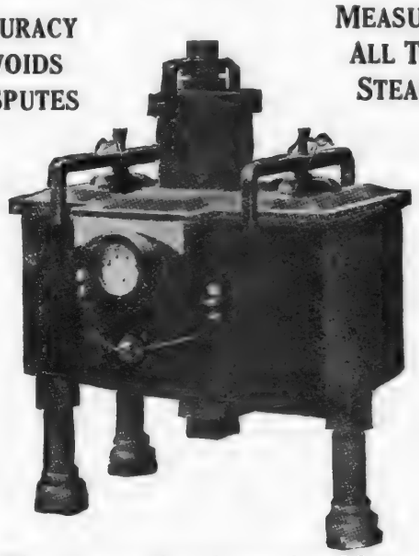
DETROIT Eighth and Porter Sts. **MICHIGAN**

ACCURACY AVOIDS DISPUTES

MEASURES ALL THE STEAM



The Mason Condensation Meter

Bucket type, measuring the quantity of condensed steam by actual displacement, for every condensate measuring service.

Especially adapted to Vacuum Systems

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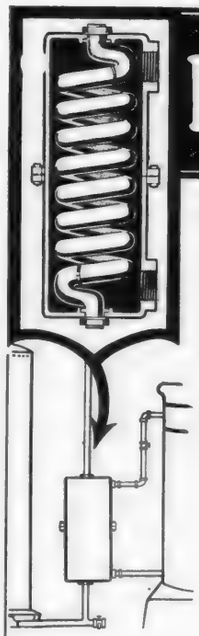

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HOT WATER
NO EXTRA EXPENSE

The most approved and economical method of heating water for domestic purposes. An abundant supply of hot water at just the right temperature, 24 hours a day, at practically no extra cost. Easily connected to outside of steam, vapor or hot water boiler; does away with fuel-wasting coil in fire pot. Uses surplus heat of boiler. Does not overheat or underheat. Will not burn out, once installed.

An unusual opportunity for live dealers. Order now and be prepared for the demand being created. We furnish cooperation and practical sale helps to give you full benefit of our national advertising. Write for full details.

The Hotstream Heater Co.

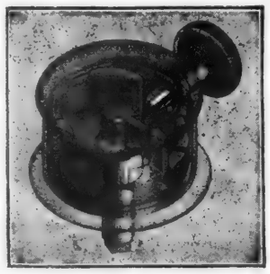
"Makers of Heaters that Heat"

Cleveland, Ohio

The **Hotstream** **INDIRECT WATER HEATER**

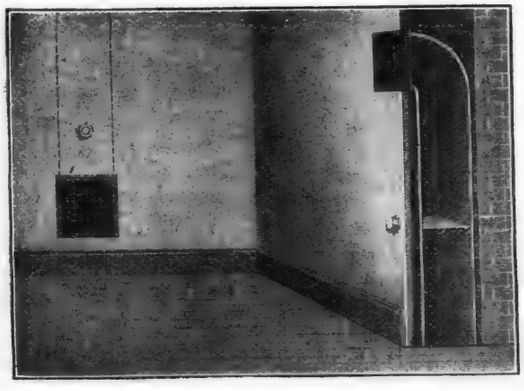
We also make a complete line of Gas and Kerosene Water Heaters.

Absolutely Prevents Tampering by Unauthorized Persons



The Perfect Damper Regulator and Indicator

positively regulates the supply of hot or tempered air in heating and venting systems.



May be placed on the wall of a room where the ventilating ducts are concealed within the wall and the damper connected to it by an extension of the square damper rod. Especially useful in school rooms to control the inflow of tempered air and exhaust of vitiated air.

Send for new circular fully illustrating and describing this device.

The Sixth City Sheet Metal Works Co.
1830 St. Clair Ave., Cleveland, O.

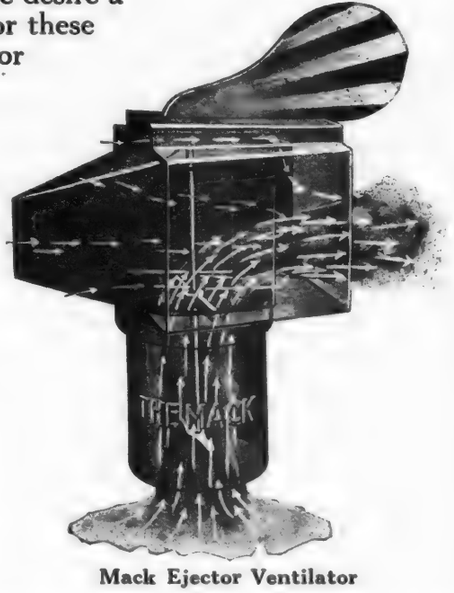
"Exhaust Without Cost"

Air-o-matic Stationary Ventilator

People differ as to what they require of a ventilator. Some desire a stationary ventilator and for these the **AIR-O-MATIC** ventilator will exclude down-drafts, snow, and rain, while it is effectively exhausting all foul air. Other people require mechanical ventilation and for these there is no device superior to the **MACK** ventilator for heavy duty under conditions of light wind.

Both of these ventilators are of sturdy, durable construction and both eliminate operating expense

Write us for full details



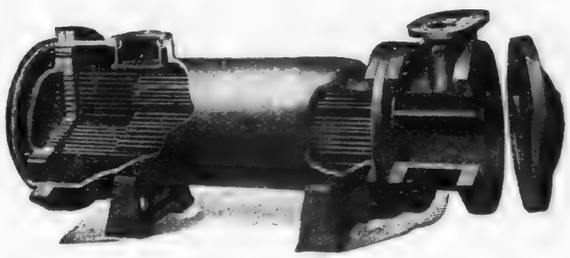
Mack Ejector Ventilator

THE STARK SHEET METAL WORKS CO., 418 Second St., S. E., Canton, Ohio

Hot Water Service Heaters

Backed by 50 Years' Heat Transfer Experience

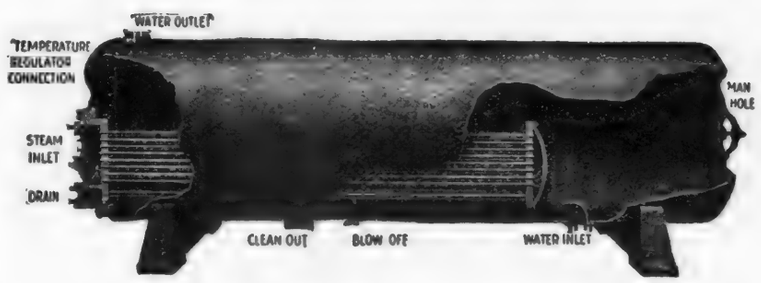
G-R Instantaneous Heater



The water passes through straight brass tubes and is heated by either live or exhaust steam in the cast iron shell.

Floating head permits expansion or contraction of tubes without strain on tube joints.

Russell Storage Heater



Constructed in accordance with modern engineering progress. Shell of boiler steel, riveted or welded.

Heating element straight, seamless drawn brass tubes.

Entire tube bundle removable. Floating head eliminates expansion and contraction strains.

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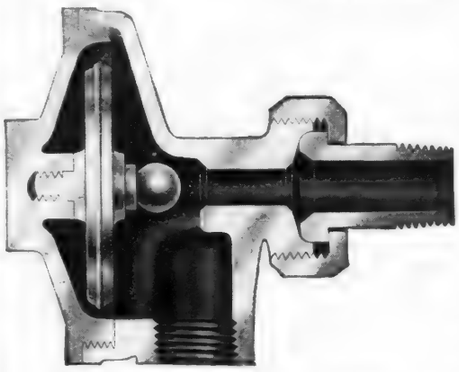
Have been successfully installed in thousands of buildings—
A RECORD OF 20 YEARS OF SUCCESS



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ILLINOIS VALVES
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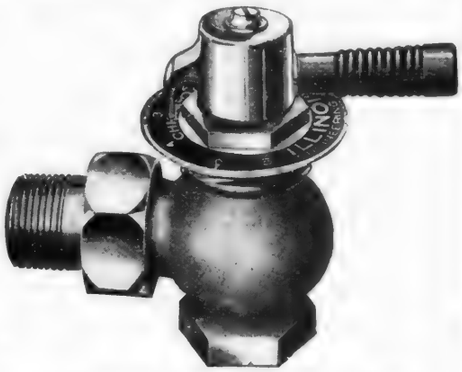

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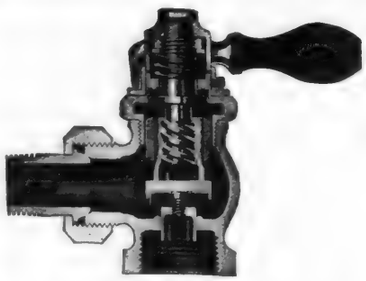

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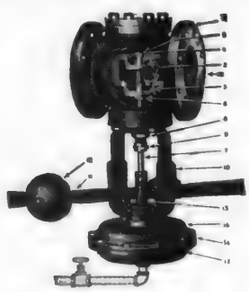

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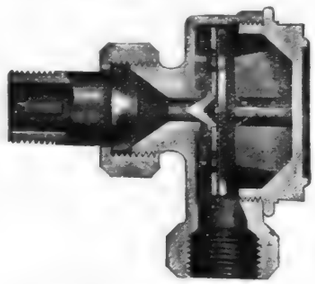

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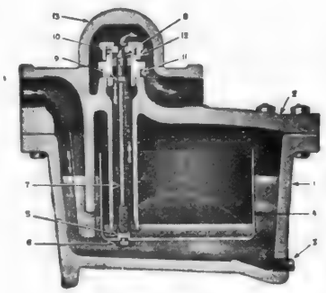

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The Heating and Ventilating Magazine

VOL. XVIII. NO. 11

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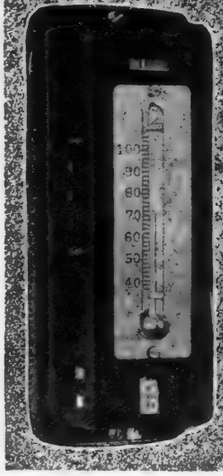

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The Heating and Ventilating Magazine

A MONTHLY JOURNAL OF ENGINEERING PROGRESS

NOVEMBER, 1921

"WHAT IS THE MATTER WITH HOT WATER?"

An Englishman's Challenge of American House-Heating Practice

BY F. BROADHURST CRAIG

Member, British Institution of Heating and Ventilating Engineers.

THOUGH it has not yet been my privilege to visit America, I have closely studied the various systems of heating and ventilation most commonly used, as set forth by its several very able authorities. THE HEATING AND VENTILATING MAGAZINE has been a welcome arrival in my office for a number of years, and, *en passant*, I often wish we had a journal of its calibre on this side.

What has very forcibly struck me on frequent occasions, is the extraordinarily few references made to low-pressure hot water as a heating medium. In England, though we certainly employ vacuum, or, as we call it, atmospheric steam heating, to a certain extent, and plenum or fan blast and unit systems for many of our larger buildings and factories; in well over 90% of our installations hot water is the favored medium. It is therefore somewhat difficult for us to understand why this system is so little used elsewhere. Its undoubted advantages over steam and hot-air heating in respect of, (1) mildness, and consequent healthfulness, (2) elasticity of operation, (3) facility of installation, and (4) economy in fuel consumption are, or should be, now so well known as to establish it as the dozen of heating mediums.

In perusing the advertisements in American trade publications, one is surprised at the large number of devices, patents, articles, apparatus and what nots that are offered to "get rid of that trouble in your heating system."

One wonders when some enterprising engineer will come along and get rid of the whole contraption. The necessity of these elaborate and complicated mechanisms seems to indicate of themselves that the fundamental principle of the parent system must be somewhat shaky.

Why have them, anyway! What's the matter with hot water?

PROS AND CONS OF WATER HEATING.

We read that the initial cost is higher, that the radiators and pipe lines are so much larger, that it takes much longer to get up heat, that there is a grave risk of freezing, and that the static pressure is too great in lofty buildings. The latter objection is certainly true,—in buildings of more than ten or twelve stories,—but the standard construction of cast-iron sectional boilers and radiators is perfectly sound for heads up to 120 ft., which is more than appertains in the majority of buildings. The rest of the objections will not bear close analysis. With a properly-designed water heating plant, the radiators are very little larger than steam, the sizes of the distributing pipes are usually as small, and in many cases even smaller. The heat can so easily be maintained continuously throughout the entire heating season, and the temperature of the circulating medium automatically and certainly adjusted at the boiler to suit the varying weather, that the risk of frost is practically eliminated.

APPLICATION OF HOT WATER AS HEATING MEDIUM NOT PROPERLY UNDERSTOOD.

The term "properly designed" is used advisedly, for therein the root of the whole objections appears to be. The application of hot water as a heating medium does not seem to be properly understood. One is forced to this conclusion in reading most of the articles and authorities on hot water pipe sizing. Expressions such as—"It is evident that the mains must be equivalent to the combined valve areas," and—"it is difficult to give any definite tabulated data of this point," not to speak of, "the system should be installed so as to make the travel of the water to each radiator about the same" and the like, admit of no other construction. As to the latter reference, the idea of equalizing the travel to each individual radiator was registered many years ago in this country, but with advanced knowledge in applying the principles of hot water circulation it soon became obsolete. The area of the main pipe need not necessarily be equal to that of the combined radiator valves. In certain instances, as, for example, a one-pipe drop system, three or four 1-in. radiator valves may be served by a single branch main of 1 in. diameter.

PIPE LINES MUST BE ACCURATELY CALCULATED.

Accurate calculation of the pipe-lines is the soul of a properly designed water heating plant, however large or small it may be.

The principles are known, the required flow and return temperatures at the boiler can be predetermined, the height and distance of each radiator from the boiler is easily obtained from the plans, and all that remains is to carefully tabulate these data with the resulting circulating pressure set up in each section of the installation, to arrive at completely accurate pipe sizes.

These calculations are by no means as involved and laborious as would be imagined at first sight. Once the governing factors are thoroughly grasped, the details can be quite rapidly figured by the average junior.

HOT WATER OFFERS FREEDOM IN DESIGN.

The freedom in design which is opened out will repay the slight trouble involved. One is conscious all the time that the job will work and, what is more, function exactly as intended by the designer. There will be no "drawing-off" from the air-taps on the radiators by the erectors in a futile effort to induce a permanent circulation—no setting up of back pressure in the nearer branches to retard the circulation through the more extreme radiators, and no air binding; just a smoothly working plant which requires an absolute minimum of attention.

If comparison is made of the cost of erector's time in making alterations and generally monkeying around to rectify even minor errors in design, it will be found that an extra shilling in the drawing office very often saves a pound on the job.

OPPORTUNITIES FOR ECONOMY IN DESIGN.

Hot water offers so many opportunities of economy in design, far more so than any other system. Differences of levels, doorways, beams, and the hundred and one little local obstructions lose their significance when hot water is the chosen medium for distributing the heat, and by this is meant with *gravity* circulation, not the so-called accelerated systems; most of which, in the writer's judgment, do not achieve anything not obtainable by gravity means, properly applied.

BOILER PIT EXCAVATIONS AND RETURN MAIN LIFTS.

An example frequently met with in practice is that of a single-story factory or workshop in which it is desired to avoid excavating a pit for the boiler, but at the same time to locate the bulk of the radiating surface at floor level. With steam this is manifestly impracticable; with hot water, however, it would be quite simply dealt with, as shown in sketch.

It is important to observe that lifting return mains *over* the

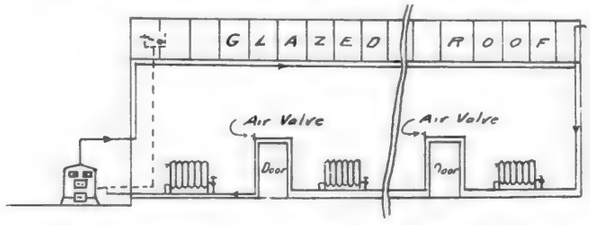


FIG. 1—HOW EXCAVATION FOR BOILER PIT MAY BE AVOIDED WITH RADIATING SURFACE AT FLOOR LEVEL.

doors does not in any way impede the circulation, beyond the relatively insignificant additional friction of the extended travel. On the other hand, dipping the pipes below the door does actually retard the circulation.

It is perfectly sound practice to extend this lifting principle almost indefinitely, always providing the pipe sizes are accurately calculated, and means taken to remove the air from each high point, just as from a radiator. An ordinary or automatic air valve will effect this, or separate ⅛-in. air pipes carried above the level of the feed and expansion tank can be very cheaply substituted.

Similarly, with the two-pipe layout.

This unique factor of water heating by gravity is very far-reaching in its practical application. There are few buildings in which advantage cannot be taken of it to avoid considerable builders' work, incidental to the installation. The total cost of the plant is accordingly appreciably reduced, since the provision of pipe trenches, etc., in an ordinarily-designed plant adds very materially to the price.

ELIMINATION OF "DEAD" MAIN PIPES.

The elimination of "dead" main pipes also makes for economy in first cost, as well as in that of maintenance. The sizes of the radiators can be reduced proportionately with the superficial area of piping exposed in the rooms, and, obviously, every foot of "dead" main means so much extra fuel to be burned in the boiler.

COST OF LARGE RADIATORS COUNTERBALANCED.

Apart from this latter consideration, the actual sizes of water radiators are not so immeasurably greater than those of low-pressure steam. With the latter it is customary to figure on an average transmission of 250 B. T. U. per square foot. A water heating plant in a building of two or three stories can be safely designed to work at a mean temperature of 200° F., and on occasion, even higher. There is no reason why the flow temperature should be maintained below 212° F., if the height of the expansion tank above the highest radiator is sufficient to create the necessary static pressure to prevent ebullition. With 200° F. mean temperature in the radiators, the transmission will work

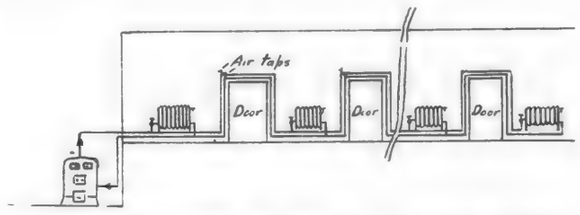


FIG. 2—ARRANGEMENT OF TWO-PIPE WATER HEATING SYSTEM WITH LIFTS OVER DOORS.

out at about $(200 - 60) \times 1.5 = 210$ B. T. U. per square foot, for an internal temperature in the room of 60° F. This represents an increase of roughly 20% in the relative sizes of the radiators for the two systems—20% on the cost of a 40 or even 50 sq. ft. radiator is less than the price of a steam trap, which is, of course, eliminated with a water heating plant.

RELATIVE COST OF PIPE LINES.

As to the relative cost of the pipe lines. A small installation for a two-story residence, with boiler in basement, total travel, say, 200 ft., will require a 2-in. pipe up to about 100,000 B. T. U. A steam plant of equivalent radiating capacity, say $\frac{100{,}000}{250}$ = 400 sq. ft. would call for a 2½-in. steam and a 1¼-in. return main. So that the cost of hot water pipe lines in this particular case would be actually less than those of steam. Again, a steam plant requires various additional boiler fittings and accessories, which for a small installation add considerably to the cost. The steam pipe sizes are based on a boiler pressure of about 8 oz. This it is not practicable to increase if it is desired to provide 8 or 10-hour firing periods, which are almost essential for satisfactory residence heating. The same objection does not apply with a water boiler. During the night, when the occupants are asleep, the full heating power of the plant is not required. In consequence, the boiler can be banked for a longer period without causing a cessation of heat, as is so frequently the case with an ill-proportioned steam boiler. What happens is that the flow temperature of the water drops to perhaps 160° or 150° F.; but the circulation is maintained, and maintained equably throughout all the radiators. If the pressure in a steam boiler falls below that for which the pipe lines are calculated, the whole of the available steam is condensed in the nearer radiators, whilst the more extreme ones become cold.

COMPARISON OF OPERATING COSTS.

The last, and perhaps the most important point, is that of running costs. This includes repairs and general maintenance charges, and fuel.

A water heating plant properly installed becomes a permanency, its life depending only on the lasting capabilities of the materials employed in the manufacture of the various apparatus. The same can hardly be said of a steam installation. The numerous

mechanical devices liable to get out of order, and so to cease functioning, from the effects of normal wear and tear have to be frequently repaired or renewed. The life of the plant itself must necessarily be less since it is subjected to the continuous strains and stresses of expansion and contraction under the variable steam pressure, and intermittent heating and cooling of the radiators.

The total relative fuel consumption of water and steam boilers show decidedly in favor of the former. Not only is the actual fuel consumption of a water boiler proportionately less than the steam type, owing to the respective differences in temperature betwen the furnace gases and the surrounding medium, but a water boiler almost automatically adapts itself to varying weather conditions. With a steam heating plant it is "all or nothing," a constant pressure must be maintained irrespective of a change in the outside atmosphere, to insure the heating of the more distantly-situated radiators. The various devices for partial heating of steam radiators, in the writer's opinion, are too dependent upon the human factor to be entirely successful, unless the resident or office occupant is prepared to spend half his working hours with one eye on the thermometer, and one hand on the radiator valve.

This "all or nothing" factor is a serious one, and has an immeasurable effect upon the annual fuel bill. It is doubtful if, all in all, 10% will cover the difference in the relative fuel consumptions of these two systems; 15% is probably nearer the mark, if allowance is made for the greater proportion of "dead-mains" in a steam plant.

Every fundamental factor—comfort, lowest first cost, and economical operation is thus in favor of low-pressure hot water. Why is it not given its proper place in the country which is truly the home of "central" heating?

A PROFITABLE MUNICIPAL VENTURE IN THE SALE OF EXHAUST STEAM FOR HEATING

BY D. D. HAYWARD

MUNICIPALITIES have long since operated water and electric departments but only a few have considered the possibilities of furnishing the greatest need of their citizens—heat.

A few years ago the City of Miles, Montana, erected a new city hall and fire station within a block of its water and electric station. It was decided that instead of installing an individual boiler in the new building they would install some underground heating pipes and heat the building by means of the exhaust steam from the electric station. Accordingly about 600 ft. of underground piping was installed and the building was satisfactorily heated without the use of live steam and with no perceptible back pressure.

THE RIGHT OF A MUNICIPALITY TO FURNISH HEAT.

The first adventure being successful, and the business men desiring the service, it was decided a year later to serve the business section of the city with heat. Accordingly plans and specifications were drawn for the underground piping system and contracts let. With materials on the ground the city was stopped from proceeding with the work by an injunction secured by one of the property owners who claimed that the city was without authority to enter into a general heating business. It was argued in the courts and decision rendered by the Supreme Court of the State that the city had a right to enter any business that an individual could, providing such business did not become a burden upon others than those directly benefited. It was later shown in court that the city was losing more than $100.00 per day by not selling the exhaust steam from the electric station and the jury decided that the city should proceed with its plan.

DEVELOPMENT OF SYSTEM.

Installation of approximately 1800 ft. of underground mains was completed during 1912, and in 1917, about 1600 ft. more were added. At the end of the year 1917 the underground system consisted of 3953 ft. of mains varying in size from 14 in. to 6 in. and 2154 ft. of services ranging from 4 in. to 2 in. Forty-seven buildings containing 4,656,300 cu. ft. of space and 65,139 sq. ft. of radiation were heated. The original cost of the distribution system was $42,508.00.

At no time during the history of this plant has exhaust steam been considered without a value to the electric department. Many cities have considered exhaust steam a waste and without value, allowing the heating department the use of such steam without paying the electric department for the steam.

OPERATING FIGURES.

We quote from the report of the Superintendent, J. J. McGill, for year ending December 31, 1917:

Investment in heating department		$42,508.10
Gross Revenue,	$16,708.00	
Labor and maintenance, $561.60		
Exhaust steam at 25c per 1000 lbs., 37,691,000 lbs. (33,137,000 lbs. sold)	9,422.50	
Depreciation, 5%	2,125.40	
Total Expense	12,109.50	
Net Income, or 10.8% on investment,	4,598.50	
Credit to electric department	9,422.50	
Total Earnings to City	$14,021.00	

or 33% on investment.

This same year the public service commission's report showed an earning of 34.5% on the heating investment. This was due to the fact that the public service commission made no charge for exhaust steam, considering it a by-product without value. This basis is erroneous, for the back-pressure on engines does slightly reduce the efficiency of engines and causes an increase in operation directly chargeable to the heating department.

The utilities of Miles City maintained their old rates in face of advances of operating cost as long as they could without detriment to service and operating results. But like all utilities they found it necessary to increase rates during 1920 and accordingly petitioned the public service commission for increases. Such increases were granted and went into effect November 1, 1920.

The rates in force as of January 1, 1920 were as follows:

HEATING.

CONDENSATION PER MONTH	RATE PER 1,000 LBS.
1st 10,000 lbs.	$0.90
Next 10,000 lbs.	.76
Next 10,000 lbs.	.73
Next 10,000 lbs.	.69
Next 10,000 lbs.	.62
All over 50,000 lbs.	.55

Minimum bill $5.00 per month.
Discount, 20% if paid before 25th.

ELECTRIC RATE — LIGHTING.

CURRENT USED PER MONTH	RATE PER K. W.
1st 50 K. W.	$0.10
Next 50 K. W.	.09
Next 200 K. W.	.08
Next 200 K. W.	.07
Next 500 K. W.	.06
All over 1,000 K. W.	.04

Minimum bill, $1.00 net.
Discount, 10% if paid before 25th.

POWER RATE.

CURRENT USED PER MONTH	RATE PER K. W.
1st 100 K. W.	$0.05
Next 100 K. W.	.04½
Next 200 K. W.	.04
Next 200 K. W.	.03½
Next 200 K. W.	.03
Next 200 K. W.	.02
All over 1,000 K. W.	.01½

Special rate of 1c per K. W. for pumping city water. This charge is made in order to separate the water and electric departments.
Minimum Rate on 1 H. P. or less, $1.50 per month.
Minimum Rate on 2 H. P. or over, $1.00 per month.

COUNTRY LIGHTING ON 6600-VOLT LINE.

CURRENT USED PER MONTH	RATE PER K. W.
1st 10 K. W.	$0.12
Next 40 K. W.	.10
Next 50 K. W.	.09
Next 200 K. W.	.08
Next 200 K. W.	.07
All over 500 K. W.	.06

Minimum bill per month, $1.50 net.
Discount, 10% if paid before 25th.

These rates were increased as of November 1, 1920 as follows:

HEATING.

CONDENSATION PER MONTH	RATE PER 1000 LBS.
1st 10,000 lbs.	$1.20
Next 10,000 lbs.	1.10
Next 10,000 lbs.	.90
Next 20,000 lbs.	.80
Over 50,000 lbs.	.70

Minimum bill, $5.00 per month net.
Rate based on $4.00 per ton Montana coal delivered at plant.
Whenever the cost of coal so delivered is more or less than $4.00 per ton, an addition or reduction, as the case may be, will be made to the rate of 2c per 1000 lbs. condensation for every 10c or major fraction thereof in the cost of coal.

ELECTRIC RATES.

LIGHTING.

CURRENT USED PER MONTH	RATE PER K. W.
1st 50 K. W.	$0.12
Next 50 K. W.	.11
Next 200 K. W.	.10
Next 200 K. W.	.09
Next 500 K. W.	.07
Over 1000 K. W.	.05

Minimum, $1.10 net.
Discount, 5% if paid before the 25th.

POWER.

Motors of 1 H. P. or less, $1.25 per month and motors over 1 H. P. per month per H. P. connected plus following rate:

	RATE PER K. W.
1 H.P. or less	$0.04
2 H.P. or less	.0375
3 H.P. or less	.035
5 H.P. or less	.0325
7½ H.P. or less	.03
10 H.P. or less	.0275
15 H.P. or less	.025
20 H.P. or less	.0225
25 H.P. or less	.02
35 H.P. or less	.0175
50 H.P. or less	.015
75 H.P. and over	.0125

Net

COUNTRY LIGHTING.

CURRENT USED PER MONTH	RATE PER K. W.
1st 10 K.W.	$0.15
Next 40 K.W.	.13
Next 50 K.W.	.11
Next 200 K.W.	.09
Next 200 K.W.	.08
All over 500 K.W.	.07

Minimum, $1.50 net.
Discount, 5% if paid before 25th.

NOTE: The slight increase in electric rate during war prices. This is due to the credit to lighting department from heating department.

OPERATION OF HEATING DEPARTMENT FOR 1920.

The operation of the heating department for the year 1920, which includes two months at the new rate is given as follows by Mr. McGill:

Investment.		
Mains, services and meters,		$52,000.00
Revenue.		
Heat sales, 55,065,000 lbs.		32,449.87
Fuel for entire plant (electric and heating depts.)	$77,738.44	
Boiler room labor	19,856.00	
		97,594.44
25% of fuel and boiler room labor charged to heating department,	$24,398.61	
General salaries and expenses, (25% of total charged to heating dept.)	2,232.38*	
Maintenance of meters, customers' inspection and reading meters,	991.19	
Replacement reserve	2,080.00	
Earnings	2,747.69	
		32,449.87

Earnings on investment 5.3%
Earnings on investment including credit to electric department of $26,630.99 58%.

If the present rate had been in force during the entire year the revenue would have been $38,691.69, or $6,241.82 increase, which would have produced an earning of $8,989.51, or 17.3% on investment, not considering the credit to the electric department. Note that overall earnings of heating department have increased from 33% to 58% in 1920.

It is interesting to note that Mr. McGill has changed for 1920 his method of allocation of station expense from that used in 1917. Formerly all steam was charged to the heating

* This item is characterized as too high by J. J. McGill, Superintendent of the Light and Power Department.

department at 25c per 1000 lbs. Now the heating department is charged with 25% of the entire fuel and labor of boiler room. This means an increase to the heating department of 57% over 1917, while the new rate to customers is but 40% increase over 1917.

The writer has further analyzed the operation of this plant operation and finds that if all steam were charged to the two departments on a live steam basis the heating department would be charged with 30%, instead of 25%, of the fuel and boiler room expense. Thus, when it is considered that practically all of the steam furnished the heating department was exhaust, we believe that 25% is a fair basis for Miles City. However, with the increasing of the electric load and the heating load remaining about the same, the time will come when 25% will be unfair to the heating department.

Mr. McGill reports that in eight years his heating load has increased until at present he is heating 98% of the business adjacent to his underground system. He has many applications from outlying districts for service but he realizes that the revenue from such districts will not pay the interest on the investment and has advised his council against such extensions.

There is no question but that our coal supply can be greatly conserved if other municipalities would adopt the same methods as are now being used at Miles City. It must be kept in mind that the fuel committees of this country and Canada laid great stress upon conserving our fuel supplies. The Canadian committee recommended the central station heating plants where greater boiler efficiency would be secured and the same amount of heating be accomplished with less coal.

WHAT ABOUT OZONE?

Details of the Recently-Completed Chicago Tests to Determine the Status of Ozone for Ventilation

BY E. VERNON HILL AND JOHN J. AEBERLY, M. E.,

Of the Chicago Department of Health.

AT SOCIETY meetings and impromptu gatherings of heating and ventilating engineers the discussion of various topics of interest to the profession is usually interrupted at some point by a question that has been asked more and more frequently in the past year or so. The question is "What about ozone?" Is it true that the use of ozone in the ventilation of schools will allow of recirculation of from 40% to 60% of the air, as its proponents state, saving perhaps 50% of the coal bill? Is ozone used in proper concentration beneficial to health, or is it not? If it is beneficial in the proper concentration what is this concentration? Are there any bad effects from its use over long periods of time? How is it affected by heat, by moisture in the air, by the duct work through which it is distributed, etc.? These and many other questions are repeatedly asked and no one seems to have the answer.

If it is true that the use of ozone will allow a material reduction in the amount of outside air required for ventilation purposes without injury to the occupants it is a practice that should be encouraged by every means possible. If it is not true steps should be taken immediately to prevent the installation of ozone equipments in schools throughout the country, and it may be remarked in passing that these installations are becoming more and more frequent.

In order to be able to answer these inquiries with a fair degree of accuracy and before any definite position could be taken in the matter we decided that a series of tests was necessary to obtain more information on some of the practical applications in the use of ozone, as well as in its physiological effects on the human organism over extended periods of time. As the manufacturers are certainly as much interested in obtaining definite information regarding ozone as health authorities and heating and ventilating engineers, it was decided to solicit their aid in providing the necessary space, equipment and assistants for the work. The matter was taken up with the Ozone Pure Airifier Co., of Chicago, this firm agreeing to lend the necessary aid in carrying out the work. The following program was outlined:

OUTLINE OF INVESTIGATION.

1. Test methods and apparatus.
2. Nature of ozone.
   Ozone concentration perceptible to the senses.
   Ozone concentration irritating to the eyes and mucous membranes.
3. Ozone production in relation to power consumption.
4. Ozone production in relation to air velocity.
5. Ozone production in relation to temperature and humidity.
6. Dissipation of ozone through clean galvanized-iron ducts.
   Dissipation of ozone through dust-laden galvanized-iron ducts.
   Dissipation of ozone in a room.
   Effects of light on ozone.
7. Physiological effects.

1—Test Methods and Apparatus:

It appeared necessary to the writers, in order to carry out the foregoing program, that we have, first, a test method that was accurate and as simple and practicable as we could possibly develop; second, a test cabinet or apparatus in which any concentration of ozone could be produced and maintained and any air conditions that would be met in ventilation practice.

In all probability the wide discrepancies in the statements by various observers regarding the occurrence of ozone, its effects as a deodorant, a germicide, its physiological effects, etc., are due to the difficulties involved in making determinations by the usual laboratory apparatus. We do not wish to convey by this statement that the common methods in use are inaccurate. The difficulty evidently lies in the cumbersomeness and non-portable nature of the apparatus and the consequent relatively small number of tests where ozone is in practical use.

Furthermore, the chemists or physicists who have carried on the very excellent investigations with ozone in the past have been interested particularly in the technical or scientific side of the problem and very little in its practical application, especially with regard to its use in ventilation. In order that definite information be obtained it is essential that a large number of tests be made not under the more or less artificial conditions created in a test laboratory, but by actual observations in the field where the apparatus is in daily use under actual working conditions, and tests of this character must be multiplied until errors due to individual peculiarities both on the part of the observer and of the apparatus are rendered negligible.

STARCH IODIDE TEST METHOD CHOSEN.

In order that this field be explored properly it appeared to

the writers that it was essential to develop a test method that was accurate and sufficiently simple to allow any ordinary engineer and careful investigator to obtain consistent results. Furthermore, the apparatus necessary should be sufficiently portable to be transported without difficulty. After reviewing the numerous test methods in use we decided that the starch iodide method is the most convenient, accurate and practical one for our purposes.

William C. Marti, chief chemist of the Municipal Laboratories of Chicago, to whose ability and interest in this work we are deeply indebted, suggested the use of cadmium iodide instead of potassium iodide, the former being considerably more sensitive, and developed the technique and calibrated the apparatus.

As used in the laboratory the starch iodide method may be outlined as follows: The air containing the ozone to be tested is bubbled through the cadmium iodide solution at a slow rate, the volume of the air being determined by a gas flow test meter. As the ozone is a strong oxidizing agent it reacts with the cadmimum iodide, forming cadmium hydroxide. Free iodine is liberated which gives the characteristic blue color with the starch. The amount of iodine liberated is in proportion to the amount of ozone passed through the solution. After a decided blue color has been obtained the solution is titrated with sodium thiosulphate ($NA_2S_2O_3$) until the blue color just disappears. As the sodium thiosulphate solution is of known concentration, usually 100 normal ($\frac{N}{100}$) it is not a difficult matter to calculate from the number of drops used the milligrams of ozone present. The action which liberates free iodine (I_2) when ozone (O_3) is drawn through a slightly acidified solution of cadmium iodide (CdI_2) is as follows:

(1) $CdI_2 + H_2SO_4 + O_3 = CdSO_4 + I_2 + O_2 + H_2O$

The subsequent action when titrating with a $\frac{N}{100}$ solution of sodium thiosulphate ($NA_2S_2O_3$) is shown by the reaction

(2) $2Na_2S_2O_3 + I_2 = Na_2S_4O_6 + 2\ NaI$

A study of the two equations regarding the amount of I_2 liberated by O_3 and the quantity of $Na_2S_2O_3$ required to react with the I_2 to form 2NaI leads to an easy method of determining the ozone used. Equations (1) and (2) indicate that each molecule of O_3 liberates one molecule of I_2 and two molecules of $Na_2S_2O_3$ are used to form 2 NaI. The relation between $Na_2S_2O_3$ and O_3 is, therefore, two molecules of $Na_2S_2O_3$, representing the production of one molecule of O_3. Expressing this relation in gram molecular weight, we have two grams molecule of $Na_2S_2O_3$, representing one gram molecule of O_3 or 1 c. c. of a $\frac{N}{100}$ solution of $Na_2S_2O_3$ representing 0.00024 grams of (O_3). 1/120 c. c. is the volume of a drop from a special dropper, therefore, one drop of the $\frac{N}{100}$ solution of $Na_2S_2O_3$ is equivalent to 0.000002 grams of O_3. As it was the purpose here to make the data obtained in this work of easy application for the non-technical man, a more convenient form of the expression 0.000002 grams O_3 is one drop of $\frac{N}{100}$ $Na_2S_2O_3$ is equivalent to 0.00006135 cu. in. of O_3 at 70° F. and 29.92 in. pressure.

DESCRIPTION OF TESTING EQUIPMENT.

The laboratory equipment required for making this test consists of a gas flow meter, a siphon pump or other instrument for drawing air through the solution and the meter, a burette for titrating and the other necessary chemical apparatus ordinarily used in work of this character, the whole being very cumbersome and extremely difficult to transport.

In order to develop a practical field method without sacrificing any part of the accuracy of the same, we proceeded as follows: For the pump and gas meter we substituted a piston pump about 1 in. in diameter and 6 in. long. This pump was carefully calibrated and found to have a capacity of 4.8 cu. in. per stroke. Two brass tubes were soldered together and attached to the pump by suitable support, these tubes being of the proper size to snugly enclose ¾-in. glass test tubes. A circular opening or window was then cut through the center of the tubes to obtain a view of both test tubes with their contents.

One of the test tubes with a close fitting rubber stopper is filled with an aqueous solution of an aniline dye, forming a distinct purplish tint, a color which very closely approximates the color produced in the starch iodide solution when acted upon by free iodine. This is used as a color standard.

The other test tube is provided with a rubber stopper with two holes. In one hole a small glass tube extends to the bottom of the test tube, its outer upper end free in the air. In the other

FIG. 1—AIR PUMP USED IN TEST.

hole a short tube is inserted with a bulb just outside the stopper. This latter tube is connected by a short piece of rubber tubing with the nozzle of the pump. Each stroke of the pump when connected bubbles 4.8 cu. in. of air through the solution.

OPERATION OF TEST APPARATUS.

In using the apparatus the test tube is filled to a point indicated by a mark on the glass with the cadmium iodide solution. The solution is made up as follows: Approximately 1 c. c. of cadmium iodide solution is introduced into the tube, one drop of normal sulphuric acid solution (H_2SO_4) and the rest of the tube up to the mark filled with distilled water. The test tube is then agitated to assure the proper mixture of the contents, the rubber tubing connected and the instrument placed in position for taking the sample. The plunger of the pump is operated very slowly, using the necessary precautions not to allow any of the solution to pass the bulb. A sufficient number of strokes is taken to produce a blue color in the tube that matches the color in the standard tube. When this color has been reached the operation

FIG. 2—AIR TESTING APPARATUS IN CASE.

is discontinued. The sample is now titrated with the sodium thiosulphate solution until the blue color disappears and from the number of drops used the volume of ozone contained in the sample is determined and from this and the number of strokes of the pump the concentration can be determined.

In titrating we substituted a special dropper for the ordinary laboratory burette. The special dropper was made from a large medicine dropper, the point carefully drawn out in a flame until one drop is equivalent to 1-1/120 of a cubic centimeter. The entire apparatus goes into a small carrying case and weighs less than 3 lbs. The carrying case also contains an additional dropper, as well as cadmium idodide, distilled water, thiosulphate and sulphuric acid. The pump ready for use is shown in Fig. 1 and the apparatus in its case in Fig. 2.

ESPECIALLY-CONSTRUCTED AIR CABINET USED.

The cabinet used in the test (see Fig. 3) is one that was originally designed for exhibition purposes at the Pageant of Progress held in Chicago during August of the present year. It was intended as a complete air-conditioning cabinet, to which visitors at the exposition could be admitted to experience various air conditions and note their effects. It was not completed in time to be exhibited at the show but makes a convenient apparatus for the work at hand. The cabinet consists of a 16-gauge sheet-iron box 96 in. long, 60 in. wide and 76 in. high, with two immovable windows and a tight fitting door. All joints and seams are riveted and soldered or cemented, making the box practically air tight.

In the interior is located an electric heater, also an electric humidifier, both controlled by indivdual rheostats on the outside. Wet and dry-bulb thermometers of the duct type are located on the front of the cabinet. The wet-bulb thermometer is provided with a small Sirocco blower for producing an air flow about the wick covering the bulb. A hand hole is also provided in front of the cabinet for passing instruments, etc., to the occupants.

At the end of the cabinet opposite from the door an ozone machine is attached. The ozone apparatus consists of a twenty-unit machine, a detailed view of which is shown in Fig. 4. Underneath the machine a small blower is connected to a duct system arranged to draw air from the outside and pass it through the ozone machine into the cabinet, or to draw air from the cabinet and pass it through the ozone machine back into the cabinet, thus re-circulating the air, or to recirculate any part of the air from the cabinet.

The ozone machine used in these tests is of the unit type, a unit consisting of a glass tube made of pyrex glass 2 in. in diameter, 10 in. long and closed at one end. The glass tube or dielectric is molded and has a uniform thickness of 3/64 in. The inside of the dielectric is provided with a sheet of aluminum foil, which is held in contact with the surface of the glass by an aluminum spring, which also serves as a terminal. The outside electrode is constructed of a special perforated stamping, also of aluminum, the perforations being triangular in shape and bent by the stamping process to form a large number of points on its inner or concave surface.

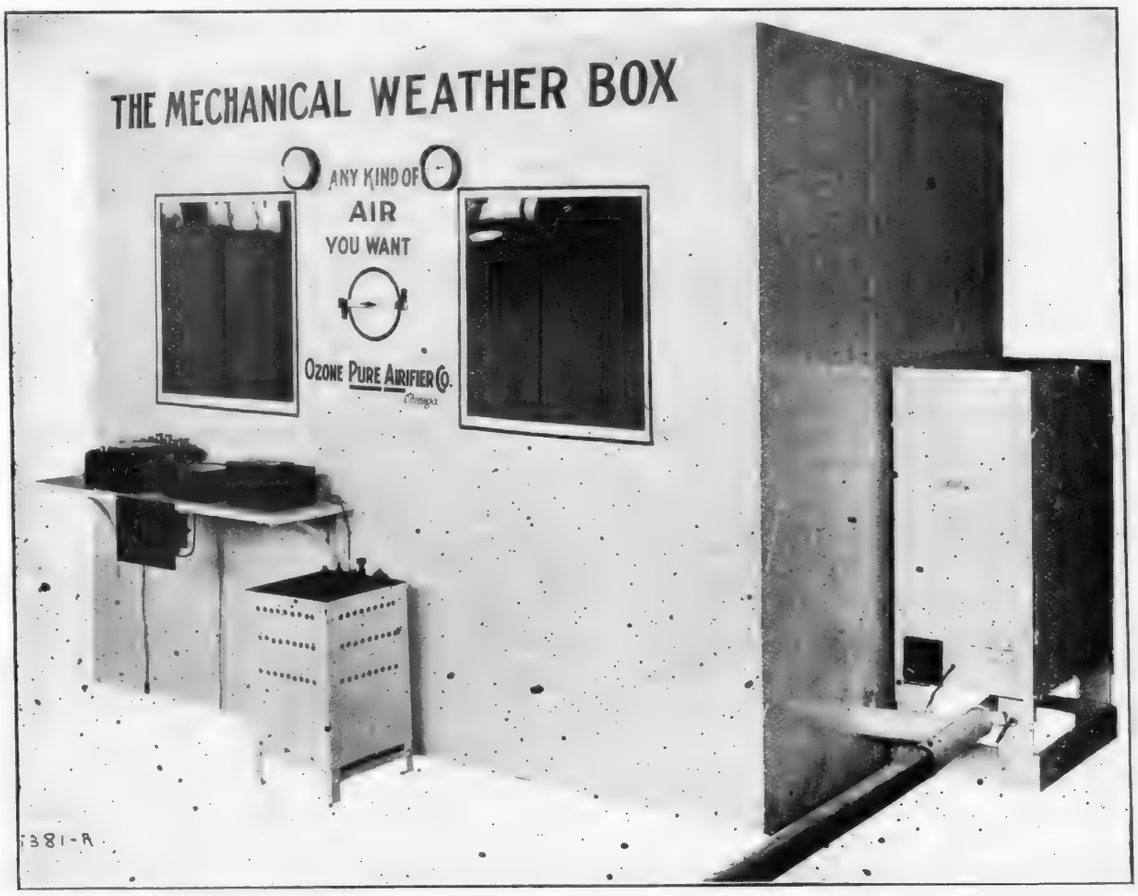


FIG. 3—AIR CONDITIONING CABINET, EQUIPPED WITH OZONE APPARATUS.

These two stampings when placed together form a cylinder enclosing the dielectric, the points coming in contact with the outer surface of the glass. There are approximately 1000 points in each unit of this size. The outside electrode is held to the glass by suitable hinged clamping devices, which also serve as footings and terminals.

The units are mounted on aluminum channels attached to an angle-iron frame, the number of units in a given machine depending upon the quantity of ozone required. The design of the unit makes it a simple matter to remove the electrodes or the

dielectric for the purpose of inspection, cleaning or repairing. Owing to this construction we are enabled easily to remove any number of units from the test machine for experimental purposes.

With the equipment we are able to maintain an ozone concentration from 1/100 part per million up to 100 parts per million, to recirculate air through the cabinet or to take air from the outside, also to maintain a temperature up to 100° and a relative humidity of 90%. In lowering the temperature in the cabinet we take the air from out of doors and the lower limits depend necessarily upon weather conditions.

The current is supplied from a switchboard having a variable

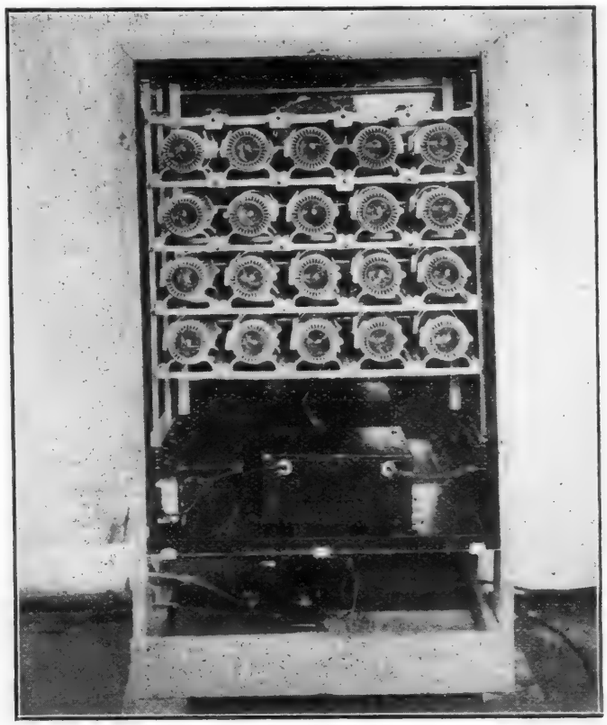


FIG. 4—OZONE APPARATUS USED IN CONNECTION WITH CABINET

voltage transformer. The current is carried from the switchboard to the ozone machine, where it enters a step-up transformer, giving the necessary voltage for ozone production. The transformer is of the stationary type and has an efficiency of 96%. In the primary circuit is provided a Weston voltmeter, ammeter and direct reading wattmeter. The values shown on the charts are readings from these instruments properly corrected. The current supplied to the switchboard is from the Commonwealth-Edison service, A. C., 60 cycle, 110 volts.

2—Nature of Ozone:

It is not the intention of the writers to enter into a theoretical discussion of the nature of ozone in this article, but for the information of the practical man a brief discussion of the generally accepted views regarding ozone may be of interest.

Schonbein in 1840 presented a memoir to the Academy at Munich directing attention to an odor noted in the vicinity of a high tension electric discharge and in the oxygen generated by electrolysis, due to the presence of a new gas to which he gave the name of "ozone" from the Greek meaning "to smell." Various speculative hypotheses were advanced from time to time as to the composition or character of ozone, but it is probable that the work of Andrews, Tait and Soret, 1876, was the first to clearly recognize ozone as an alletropic form of oxygen, having the formula O_3. Soret filled a tube connected to a sulphuric acid manometer with oxygen gas. The gas was then submitted to the action of a spark discharge, which converts the oxygen into ozone. As was to be expected, he noted a contraction in the volume of the gas in the tube. Upon heating the tube to 270° C, the ozone was destroyed and the gaseous mixture then returned to its original volume. As a result of this and other experiments Soret came to the conclusion that a molecule of ozone consists of three atoms of oxygen, three volumes of oxygen combining to give two volumes of ozone.

Ozone possesses a strong, penetrating odor that is very characteristic and can be detected in very low concentrations. Rideal states that one part of one million can be noted by sense of smell. We find much lower concentrations easily detected by the sense of smell and will have occasion to discuss this more in detail later. Ozone is colorless in small quantities, but has a skyblue tinge through stratas 5 in. or 6 in. deep.

Ozone is readily soluble in water and in diluted acid solutions. Its predominating characteristic is a strong oxidizing agent, readily uniting with practically all the elements excepting gold, liberating iodine from potassium iodide and bringing about the oxidization of numerous substances, such as lead sulphide and ferrocyanides; it unites readily with organic compounds, finding, therefore, a useful field as a deodorant. Due to its strong oxidizing properties it has a germicidal effect when used in proper concentrations.

In next month's issue, the authors will present curves showing the results of tests, concentrations of ozone that are perceptible and effects of moisture, etc., on ozone production.

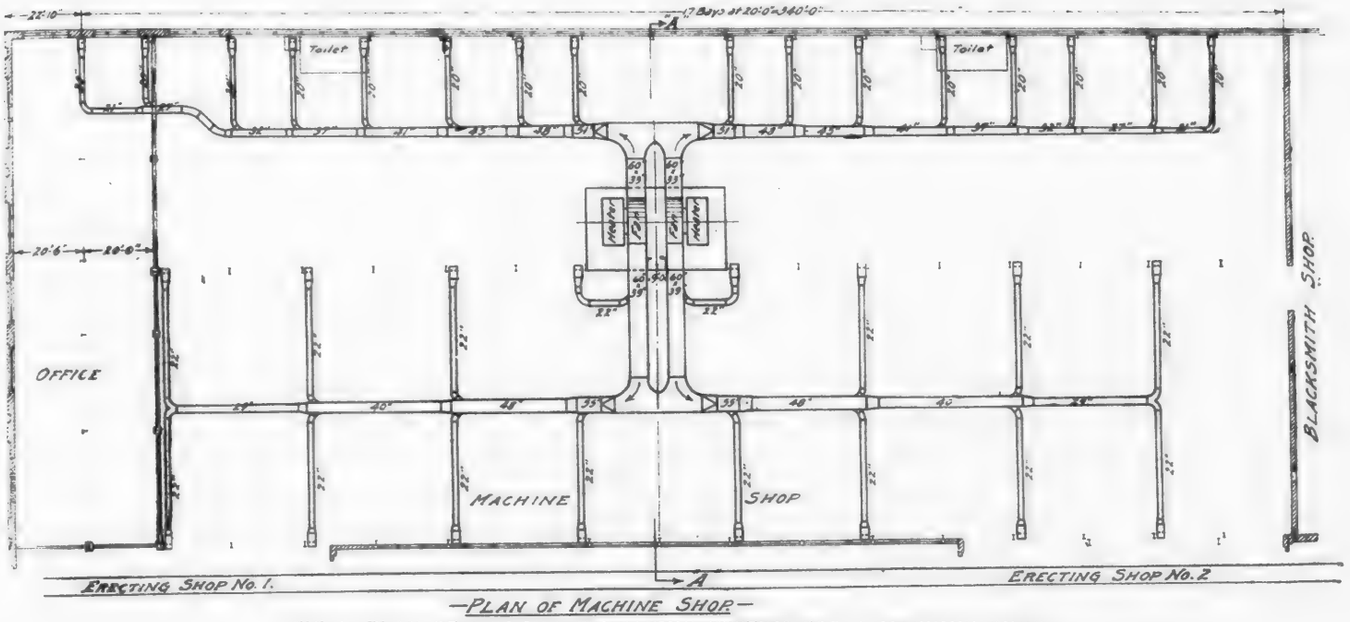


FIG 1 PLAN OF FAN BLAST HEATING SYSTEM FOR A MACHINE SHOP.

A TYPICAL BLOWER SYSTEM IN A MACHINE SHOP

A method of fan blast heating commonly adopted in shops of brick and steel construction is shown in plan and cross section of a machine shop in the West Albany yards of the New York Central Lines, Figs. 1 and 2. In this arrangement, the fans and heaters are placed overhead and the main distributing ducts extended through the roof trusses, as shown, with branches brought down on building columns so as to discharge the air at a slight angle.

Each drop pipe is provided with one or more outlets which are placed at different elevations and equipped with adjustable deflectors so that the height, direction and quantity of air discharged may be varied to suit the requirements. As shown in Figs 3 and 4, the lowest outlet (7 ft. from the floor) is provided with a screen of No. 16 B. W. G. wire, 5/8-in. mesh, enclosed in a hood of No. 12 U. S. G. steel which is made adjustable for various angles of discharge Further details of these outlets are shown in Fig. 5.

Considerable difficulties in obtaining the necessary area in a desirable cross section are often experienced in the running of drop pipes between the wall and crane girders, the cross section usually being made in the round form, with transformations for economy of space to rectangular shapes near outlets, as shown in details (Fig. 2). The greater number of outlets are placed in the drop pipes on the center row of columns.

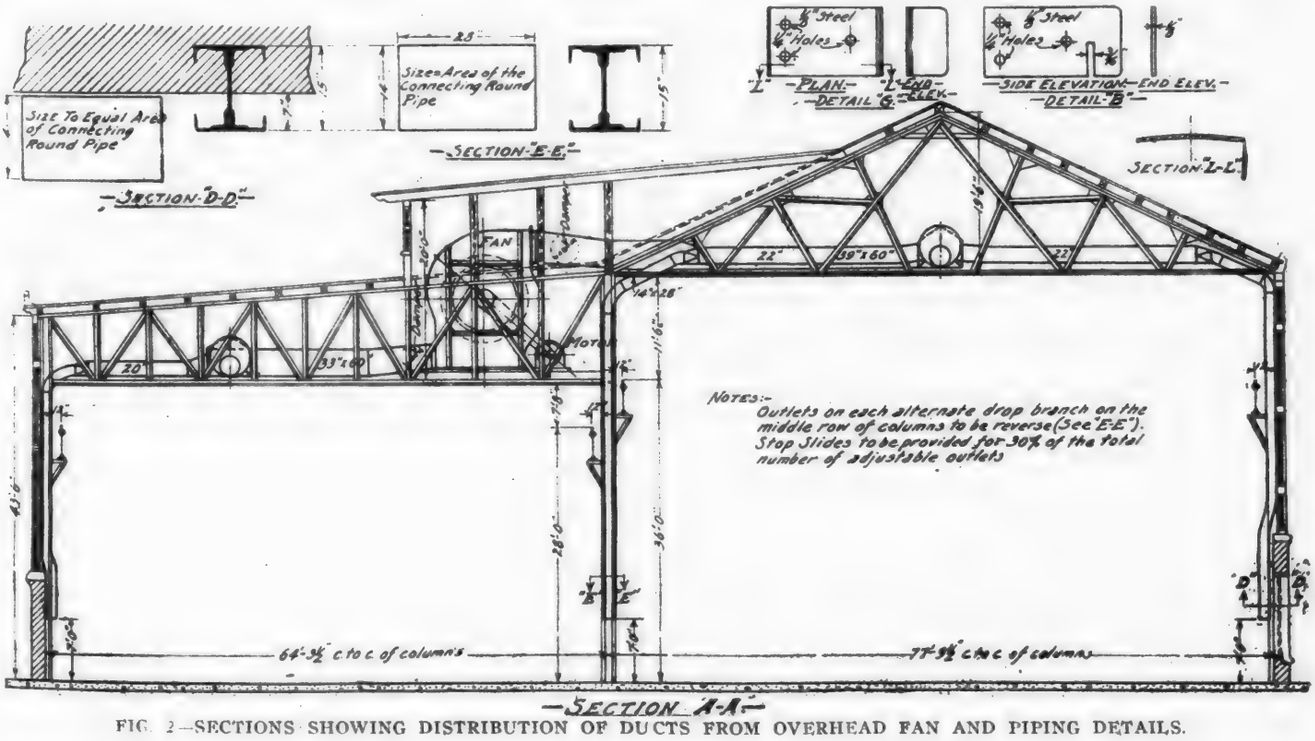
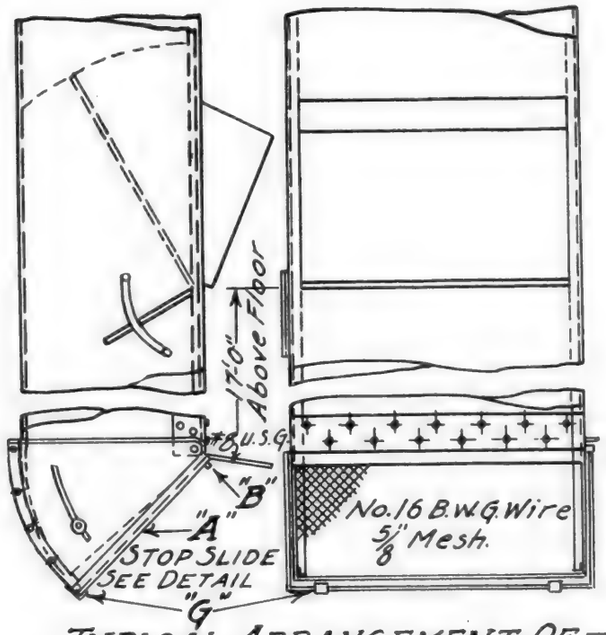
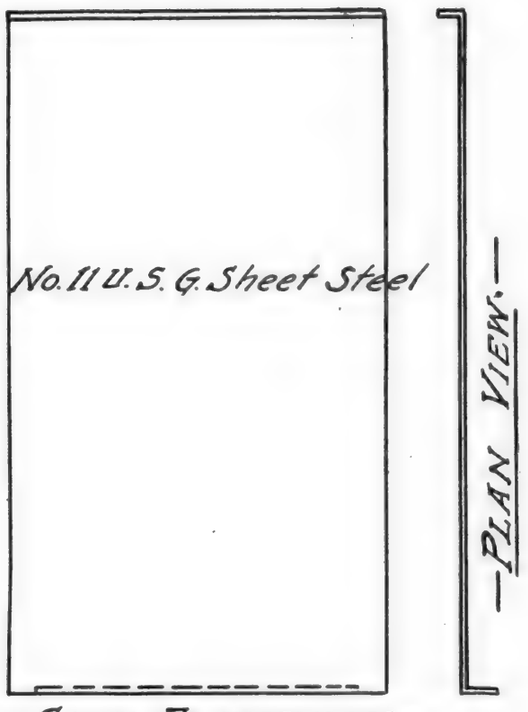

Size To Equal Area of Connecting Round Pipe
—SECTION "D-D"—
Size=Area of the Connecting Round Pipe
—SECTION "E-E"—
—PLAN— —DETAIL "G"— —END ELEV.—
—SIDE ELEVATION— —DETAIL "B"— —END ELEV.—
SECTION "L-L"
FAN
NOTES:-
Outlets on each alternate drop branch on the middle row of columns to be reverse (See "E-E").
Stop Slides to be provided for 30% of the total number of adjustable outlets
64'-3½" c to c of columns
77'-3½" c to c of columns
—SECTION A-A—

FIG. 2—SECTIONS SHOWING DISTRIBUTION OF DUCTS FROM OVERHEAD FAN AND PIPING DETAILS.



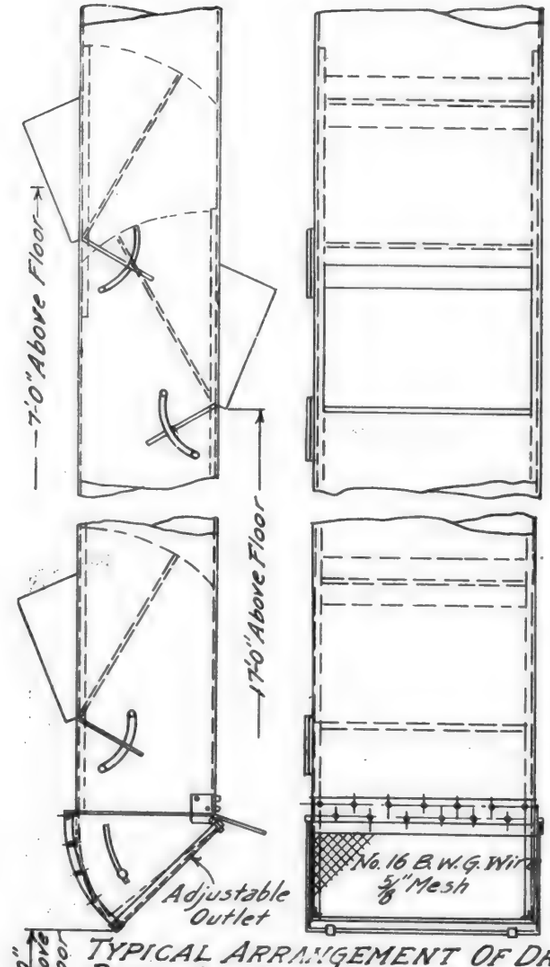
—TYPICAL ARRANGEMENT OF—
—DROP PIPES ON No. & So. WALLS

FIG. 3.



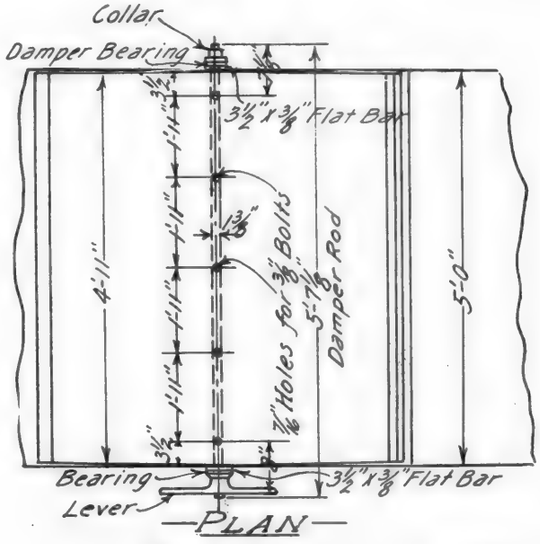
—SIDE ELEVATION.—

FIG. 5—DETAIL OF STOP SLIDE FOR ADJUSTABLE OUTLETS.

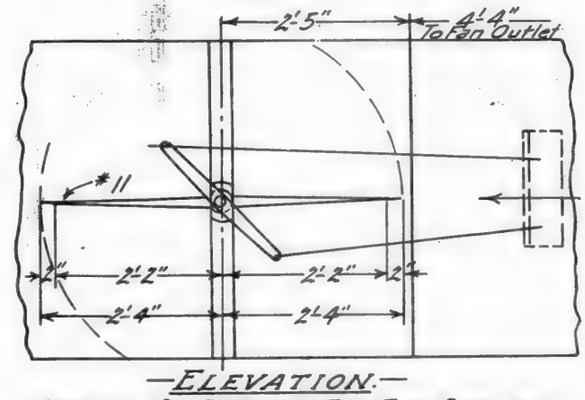


TYPICAL ARRANGEMENT OF DROP PIPES ON MIDDLE ROW OF COLUMNS.

FIG. 4.



—PLAN—



—ELEVATION.—

—DETAIL OF DAMPER FOR FAN OUTLET—

FIG. 6.

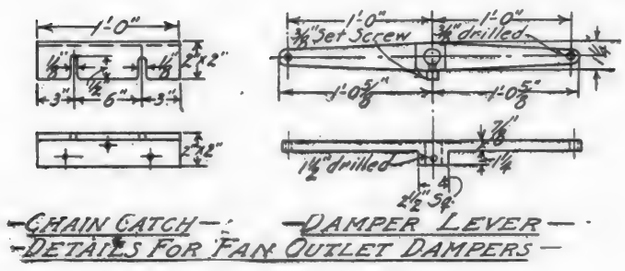


FIG. 7.

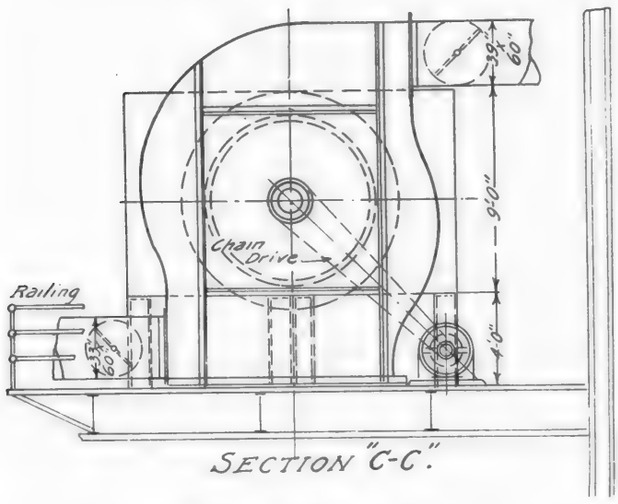


FIG. 11—SECTION AT FAN.

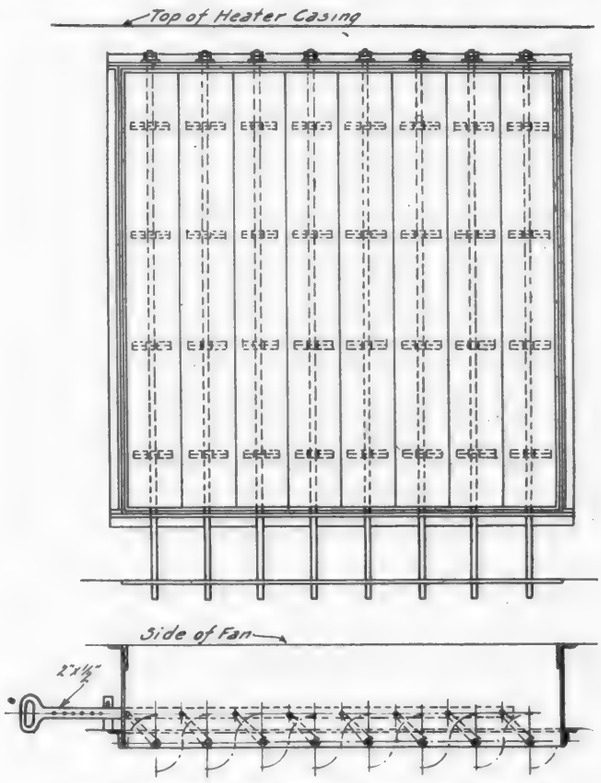


FIG. 8—DETAIL OF LOUVRE DAMPERS AT FAN HEATING SETS.

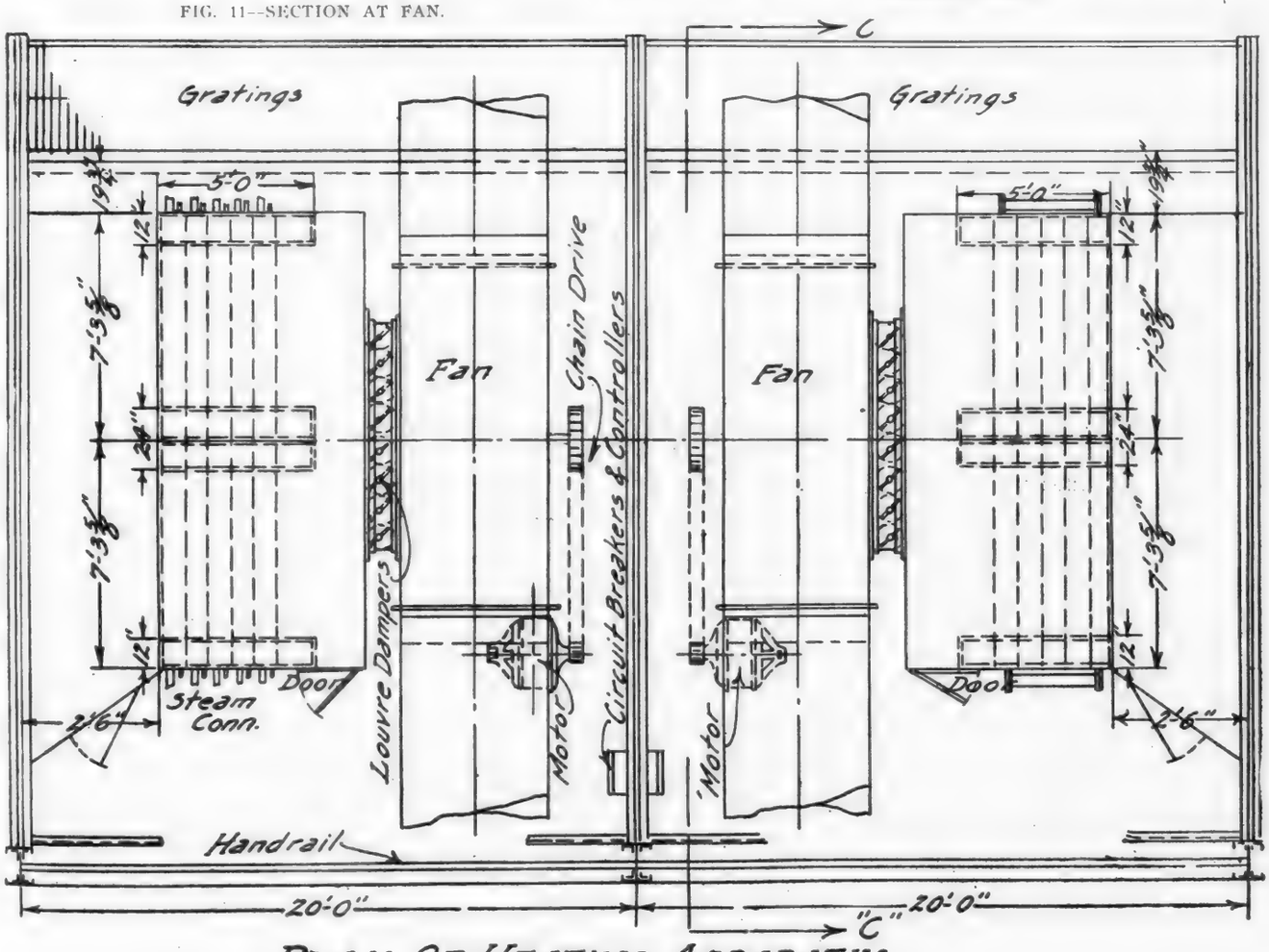
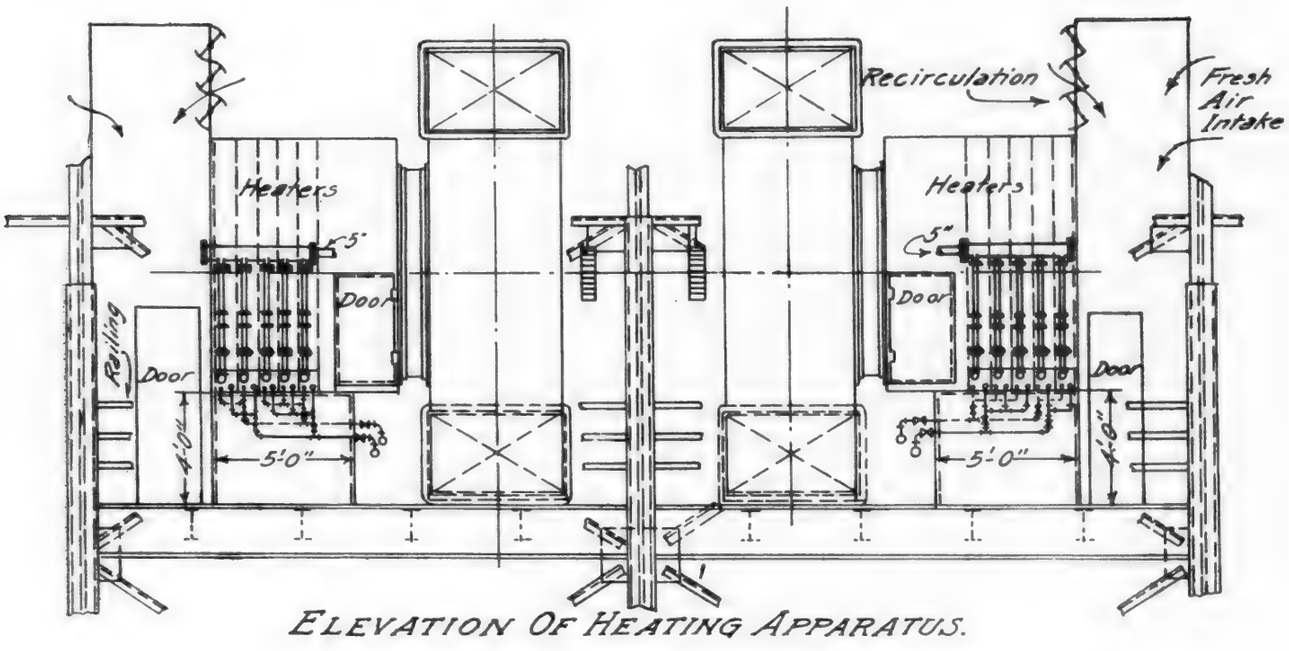


FIG. 9—DUPLICATE ARRANGEMENT OF FANS AND HEATERS.



ELEVATION OF HEATING APPARATUS.

FIG. 10.

Since the building is of considerable length, the heating sets are arranged in duplicate—a more flexible arrangement and one permitting both sets to operate together or independently, or either set to operate while the other is closed down. In like manner, the two fans are each with top and bottom horizontal discharge into the same system of ducts, so that the system is in reality quartered, and each fan at its point of connection to the system is provided with two deflectors which may be set so as to discharge wholly or partially in either direction. A stop damper is also located midway of the deflectors so that the air to either side may be throttled if found desirable. Thus it will be seen that the system can be run to a certain extent in accordance with weather conditions or repairs on any section of the system while the supply of air to any section may be cut down or built up as found desirable.

A detail of the usual main duct damper to be placed in the fan discharge is shown in Figs. 6 and 7, while Fig. 8 shows the construction of louvre dampers when placed between the fan and the heater. Each set of apparatus is connected by means of a casing to louvres in the outside wall and also to the room so that fresh air or recirculated air may be supplied as desired. A door provides access to the casing and heater coils.

Figs. 9-11 inclusive show the arrangement of heating sets with piping connections and drips. These sets are installed on an overhead gallery which is equipped with a railing and access ladder. Each fan is motor-driven, with a guarded chain drive.

The cubical contents of the building and its exposed areas in glass, wall and roof are noted on the cross section, the required temperature being 65° F.

BACK TO FIRST PRINCIPLES

Lesson No. 7—Human Ventilation Requirements (Concluded)

BY REID DAVIES

DETERMINING AIR IMPURITIES

Populated interiors so seldom contain dangerous quantities of explosive, combustible, or poisonous gases, that it is not usual to run tests for their determination. The escape of illuminating gas from an unlighted fixture or from a loose joint, or the production of excessive carbon monoxide from the incomplete combustion in a furnace or boiler, will occur occasionally. Even less frequently there will be released dangerous gases from the evaporation of gasoline, naphtha, or ether. Fortunately all of these gases have distinctive odors which serve as warning of their presence, and the sense of smell is therefore the principal means of detection in such cases. When searching for the source of impurities of this character, the use of a flash lamp is apt to give better if not always quicker results than those to be obtained with a match.

The first step in a determination of bacteria content is exposure to the air for a definite time, of a plate covered with some substance which will retain any bacteria-laden dust particles which come in contact with it. This plate is then incubated at a favorable and constant temperature for a fixed period after which a microscopic count is made of the number of bacteria colonies which have developed. Comparison of this count with arbitrary practice standards, gives a direct measure of the percentage of bacterial impurities. By use of the microscope it is also possible to determine the kind of bacteria present and this is often of large importance.

Dust determination is effected by a somewhat similar method. A sample of the air under test is blown against a glass plate covered with an adhesive substance which serves to catch and hold the dust particles. Microscopic count of the number of particles on the plate gives a basis for computing the number

of particles per unit volume of air. Comparison of the latter figure with practice standards gives the approximate percentage of dust impurities present.

The testing of air for odorous impurities is a very difficult matter. The quantity of impurity which will produce a clearly perceptible odor is so small as to almost preclude chemical analysis and the fact that these impurities are frequently of complex organic character adds to this difficulty. A rough means for obtaining approximate measure of this kind of impurity is to compare the observed odors of the air under test, with the odors of prepared air samples designed to illustrate successive grades of stuffiness. Fortunately this test is one in which no great degree of precision is necessary.

The testing of air for carbon dioxide content is not often essential, because that gas is neither combustible nor poisonous and is only dangerous in percentages which tend to produce suffocation. However, where it is desired to make such determination the test method is simple and depends usually upon the absorption of that gas by some liquid or upon some chemical action caused by it. For instance, the action of carbon dioxide upon lime-water produces a white precipitate of calcium carbonate, according to the following chemical formula:

$Ca(OH)_2$	plus	CO_2	gives	$CaCO_3$	plus	H_2O
lime-water	"	carbon dioxide	"	calcium carbonate	"	water

Power plant engineers have long been testing flue gas for its carbon dioxide content and the determination of this impurity presents no great difficulty to the ventilating engineer.

Of interest in connection with present-day ventilation standards is the synthetic air chart devised by Dr. E. Vernon Hill, as an outline for complete tests on air conditions. This chart allows a rating of 80% for 50,000 dust particles per cubic foot of air, 60% for 100,000, and 40% for 150,000. It gives 90% for 50 bacteria colonies on a two-minute plate, 80% for 100, and 70% for 150. Ratings on odors are determined by comparison with standard samples and are incapable of simple explanation. For 19 parts of carbon dioxide per 10,000 parts of air, a rating of 95% is allowed, 90% for 34 parts carbon dioxide, and 85% for 49 parts. By combining these ratings with others on temperature, humidity, air motion, and distribution, there is computed a final rating which is labelled "percent of perfection." Presumably the standard of 100% perfection is the outdoor atmosphere in the far-distant land of Utopia.

AIR PURIFICATION APPARATUS

In general, the problems of air purification are concentrated at the point preceding its supply for human use, but there is another phase of air purification which is no less important, that is, preventing pollution of the atmosphere by exhausts from chimneys and various smoke, gas, or dust-producing processes. The more general problem will be discussed first.

Under Lesson 6 it was stated that the impurities possibly present in air are explosive or combustible gases, poisonous gases, offensive odors (due to the presence of gases which may be otherwise harmless), bacteria, dust, and excessive CO_2. It was also stated that the presence of explosive, combustible or poisonous gases is of rare occurrence, that the bacteria problem is one with the problem of dust content, and finally that the presence of CO_2 is not dangerous, except in quite large quantities. Then the problem of air purification is narrowed down to the two main functions of removing offensive odors and removing dust.

TWO TYPES OF FABRIC SCREEN AIR FILTERS.

The simplest apparatus for air purification is the fabric screen, types of which are shown in Figs. 1 and 2. The accordeon pleat type, illustrated by Fig. 1, presents in a limited space a large area of filtering surface and at the same time a minimum of resistance to the passage of air. Corresponding to this advantage is the disadvantage that this type of filter will remove only the largest dust particles. The character of the fabric used, has a bearing, of course, on the efficiency of the filter, but if the fabric is too thick or its weave too fine, the decrease in size of particle which will pass it, is balanced by a decrease in the velocity of the air in passing through it.

The multiple type of fabric filter, shown in Fig. 2, illustrates the parallel arrangement of screens as distinguished from the

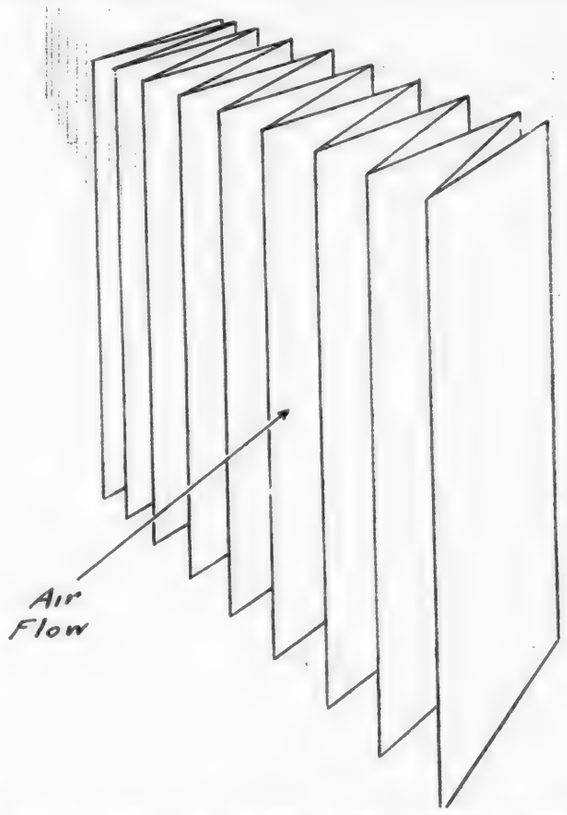


FIG. 1—FABRIC AIR FILTER, SERIES TYPE, HOUSING REMOVED.

series arrangement previously described. This multiple type also provides for a considerable area of filtering surface in a limited space, but its effect is to produce a more thorough cleansing of the air and at the same time a much greater decrease in air velocity than the series type, previously called the accordeon pleat type because of its resemblance to a great accordeon pleat. In reality, the multiple or parallel type of fabric screen is better adapted and more used for the cleansing of exhaust to prevent atmospheric pollution and its description belongs rightly in the second half of this discussion. It is here described because of its relation to the series type of filter. In neither type is there any possibility of removing offensive odors.

AIR WASHING APPARATUS.

Fig. 3 shows another form of air-purifying apparatus called an air washer, which will not only remove dust of all sizes, but will also remove from the air any gaseous impurities which are soluble in water. Moreover, the air washer does these things with considerably less obstruction of air flow than is experienced with any form of fabric screen filter. The balancing disadvantage is that an air washer costs more to install and operate than does a fabric screen filter. However, there are many cases where the greater efficiency and capacity of the air washer far more than make up for this increased cost.

The principle of the air washer is fundamentally simple. Entering the washer, impure air has to pass through a barrage

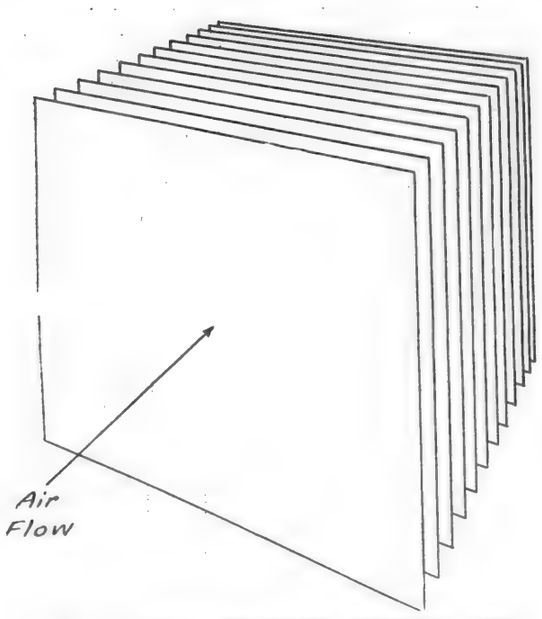


FIG. 2—FABRIC AIR FILTER, PARALLEL TYPE, HOUSING REMOVED.

of mist projected from spray nozzles pointed in the direction of air flow. The effect is similar to that of a hard rain storm, except that the mist is much more finely divided and the cleansing much more thorough than that of a rain storm. On leaving this artificial deluge, the air has lost its dust and any of its gas contents which are readily soluble in water, but it has picked up a considerable quantity of mist which would not be desirable in the air supply of a room. This excess moisture must not be confused with water vapor which is desirable for humidification of the air supply. The mist content is removed by passing the cleansed air through a series of baffles, called an eliminator, whose action is entirely similar to that of a steam separator.

ELECTRIC OZONATOR.

The air-purifying apparatus, shown in Fig. 4, is known as an ozonator and its field of usefulness lies in removal of fine dust

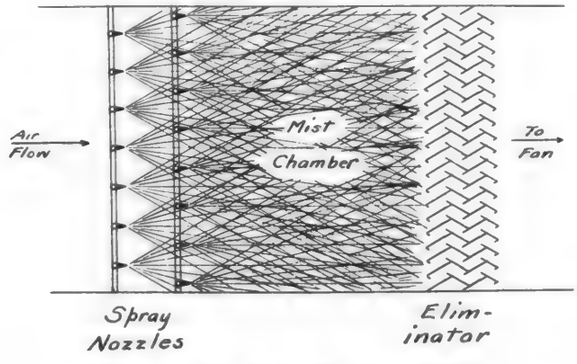


FIG. 3—PLAN VIEW OF AIR WASHER.

particles, such as smoke, and of such gas impurities as can be rendered harmless by oxidation. The operating principle of the ozonator is also simple, but, as with the air washer and almost any other piece of mechanical or electrical apparatus, the refinements which make it a practical success are numerous and often complicated. For our immediate purposes the fundamental principles are sufficient.

In the case of the ozonator, an alternating current of high potential is arranged to discharge from a number of pointed electrodes through a dielectric (non-conducting substance, such as glass or any of a number of similar materials). This discharge produces a chemical effect upon the oxygen surrounding the apparatus, which can be best described as the formation of a new substance called ozone. One difference between oxygen and ozone is that the molecule of oxygen contains two oxygen atoms and is written O_2, while that of ozone contains three

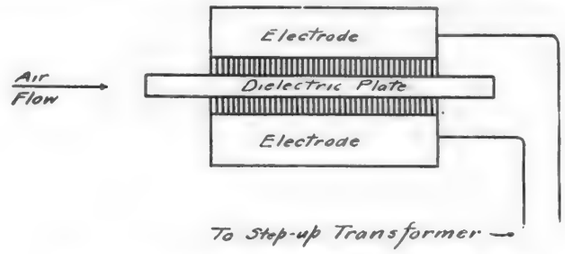


FIG. 4—ELECTRIC OZONATOR, DESIGNED FOR BRUSH DISCHARGE.

atoms and is written O_3. Because both are made from the same element, ozone is called an allotropic form of oxygen.

Another difference between ozone and oxygen is that, while the oxygen molecule is comparatively stable, that of ozone is very unstable. At the slightest opportunity it throws off its extra atom of oxygen and becomes again an oxygen molecule. The atom thrown off is in a nascent state, meaning just born, and is a much more active oxidizing agent than oxygen in its molecular form. So it is not the ozone itself that makes an ozonator valuable as an air-purifying device, but the nascent oxygen released by decomposition of this ozone.

Of the three pieces of apparatus above described, the fabric filter may be said to serve only for dust removal, the air washer for removal of both dust and gaseous impurities, and the ozonator mainly for removal of gaseous impurities. Conditions can be imagined under which it would be good engineering to use any one, any two, or even all three of these devices. The air washer has, up to the present, enjoyed the widest application of the three, but in the future the combination of air washer and ozonator is likely to find even wider use.

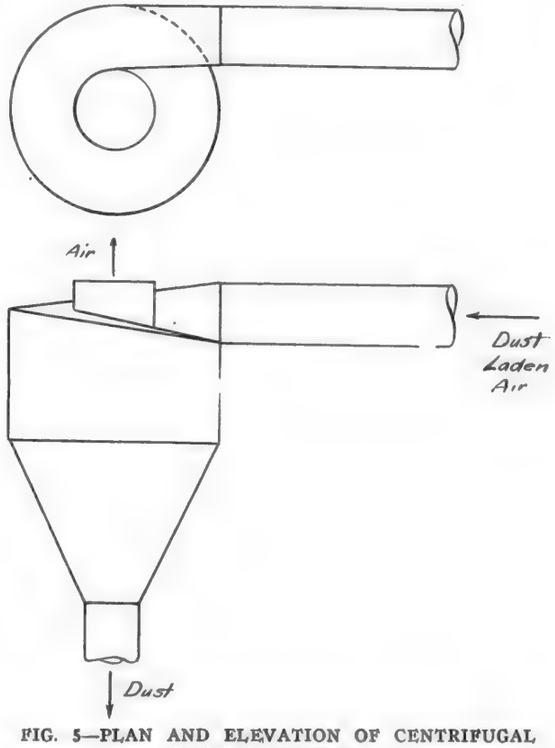


FIG. 5—PLAN AND ELEVATION OF CENTRIFUGAL DUST COLLECTOR.

DUST COLLECTING APPARATUS.

While these devices are all primarily used for cleansing air prior to its supply for breathing, they are all of possible value for cleansing exhaust air prior to its release to the atmosphere. However, this service often has peculiar requirements which dictate the use of different equipment. For instance, the exhaust air may carry fibres, or shavings, or other light particles in such volumes as would quickly put out of commission any fabric filter or air washer. For such service, as well as for the equally heavy duty involved in removing abrasive dust, the dust collector, illustrated in Fig. 5, is preferable. By passing the air back and forth through a series of baffles the fibres, shavings, or dust

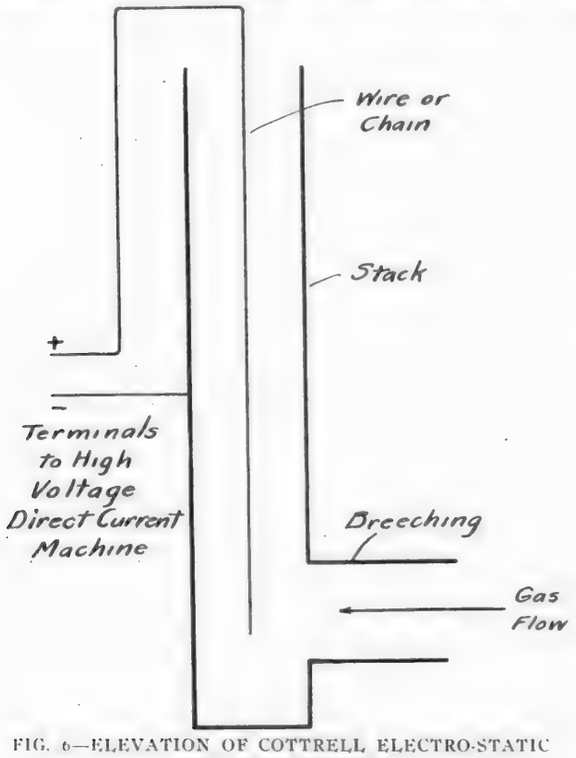


FIG. 6—ELEVATION OF COTTRELL ELECTRO-STATIC DUST PRECIPITATOR.

are thrown off and drawn by gravity to the hopper below, from which they can be dumped with little loss, while the air escapes from a vent at the top of the collector.

COTTRELL ELECTRO-STATIC DUST PRECIPITATOR.

In many instances the exhaust is at a high temperature and under this condition still other means are necessary for removing smoke, or other solid or gaseous impurities. For such service the best apparatus yet devised is the Cottrell electro-static precipitator, the structural details of which are suggested in Fig. 6. In this device the terminals of a high potential, direct current circuit are attached, one to the stack "A" and the other to the wire or chain "B," extending along its axis of revolution. When the circuit is closed and the potential adjusted to produce a good corona effect, without danger of sparking, there is produced in the space between the wire and the stack an electrostatic field. As the exhaust gas passes through this space, any dust or smoke particles which it may contain accumulate electric charges of the same sign as that of the wire (positive) and are at once drawn toward the sides of the stack which is oppositely charged (negative). By rapping the stack this deposit of dust or smoke particles is discharged by gravity into the hopper below.

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Questions.

1. Describe the human respiratory process.
2. What controls the frequency and depth of breathing?
3. What is the most widely specified volume of fresh air per minute per person?
4. From the standpoint of good ventilation, where should the air supply registers be located in a room? Where should the exhaust vents be located?
5. Name the various impurities which may occur in air.
6. What is the most obvious method of air purification?
7. What other desirable result is accomplished by the removal of dust from the air?
8. Describe methods of testing air for bacteria content, dust content, odors.
9. Describe several forms of apparatus used for cleaning air prior to its use for breathing.
10. Describe several forms of apparatus for removing dust, smoke, and other impurities from air prior to its exhaust into the atmosphere.

INSTRUCTION COURSE FOR CUSTODIANS AND JANITORS

Lesson 10—Handling Coal and Ashes

BY EDWIN S. HALLETT,
Chief Engineer, St. Louis Board of Education.

THERE are so many systems of purchasing and storing coal in large school buildings that it is apparent there is much room for improvement and economy in many of them. It is highly desirable that the coal supply for the season be stored in convenient bunkers that shall not require removal until needed for the boilers. The coal contractors bid quite a bit lower for Summer storage and the labor of the custodian force can best be spared for storing at this time.

STORING COAL TO AVOID SPONTANEOUS COMBUSTION.

Many cities have been deterred from putting in Summer storage from the fear of spontaneous combustion. There is now no longer any occasion for this fear. The careful observance of the following regulation will positively prevent bunker fires with any kind of coal. The lowest grade of soft coal has been stored in lots of 200 to 300 tons in each of 140 schools in St. Louis without a single fire. Fires from spontaneous combustion in coal are caused by the accumulation of fine coal, or slack in conical masses so that the slow escape of the volatile matter in gas form accumulates in the hollow space under the cone, where the combustion gradually heats the mass of coal to a temperature which produces smoke.

In the process of dumping the coal through a window or other opening the fine coal which is always present in some quantity tends to build up under the window. If any of the coal is wet it increases the danger because it makes this cone of slack more gas-impervious, resembling a hot-air balloon. This is the principal reason that moisture hastens combustion. It of course acts as a catalizer also.

The whole secret consists in preventing the accumulation of this cap of fine coal. This is done by the use of a coal chute to spread the fine coal evenly about the room. Some have resorted to ventilating ducts through the coal but even this is not fully effective unless it is understood that it is the pockets of gas made by fine coal that produces the fire. Where coal must be stored in a damp cellar or against a damp wall ventilation should be provided by carefully stacking large lumps of coal in such a way as to permit the movement of air through it. This small attention has entirely prevented fires in a building that has previously had a fire almost annually. Where slack or screenings must be stored as for stoker use fire will be avoided if the coal is spread on flat horizontal layers and the same precaution taken that is necessary with lump coal.

EXTINGUISHING COAL FIRE.

There are perhaps many custodians who would run to the nearest fire alarm box and call the fire department if they discovered a coal bunker on fire. This should not be done if he knows how to put out the fire. The fire department cannot get the chemical extinguisher to work in the coal and water will seldom put out a coal bunker fire. In fact the addition of a moderate amount of water quickens the fire.

The proper procedure is to begin at the bottom and move the coal necessary to open a cut or channel straight through the pile to the point from which the smoke emanates, which will usually be under the window through which the coal was dumped. When the fire has been reached it may break into flame, if so a little water may be thrown on it, but it is best to wheel this mass out. The ventilation of the room to permit the removal of the coal is necessary. A fire may smolder and smoke for several days, but no delay should be permitted in reaching the fire.

The deterioration of the heating value of coal when stored in a dry place is very small. Many engineers have erroneous opinions on this subject because in their experience in burning bituminous coal, long in storage, especially when stored in the weather it does not seem to give the heat in steaming. This is largely due to the fact that stored coal breaks up and falls through the grates. The excess coal in the ash will indicate this fact.

HANDLING THE COAL FROM THE BUNKERS.

Many custodians and building officials will welcome an improvement in handling the coal to the point of charging the furnaces. This, of course, is for hand-fired boilers.

To begin, the coal bunkers should be on the same level as the boilers. An old and abominable practice was to depress the boilers in a pit to make head room for the pipe work. The only acceptable plan now is to make boilers and coal bunkers on the same continuous level and make all other considerations secondary. In the ordinary school plant two charging trucks each holding about 1500 lbs. should be used. The coal should be broken up to 3 or 4 in. size before loading in the bunker and the coal shoveled directly from the truck to the grates. One side of the truck body hinges down to horizontal. A record should be kept of all coal burned, whether platform scales are provided or not. It is not necessary nor hardly advisable to maintain scales for this purpose. The contents of the truck can be found and this measure is about as accurate as the ordinary scale as maintained in a basement. The custodian should know how many cubic feet of coal as stored are required to make a ton. The soft coals run from 38 cu. ft. to 42 cu. ft. per ton.

ASH REMOVAL.

A satisfactory method of removal of the ashes from school and other buildings has been the most obstinate of solution. All kinds of mechanical geniuses have tried their hands and the problem is still with us. The time-honored ash pail and rope and pulley survive perhaps in the largest majority. The power-driven endless-chain bucket chute is effective and reliable, but it is a nuisance in a city community both as to dust and noise. It is quite expensive to install and is an ugly outfit. The direct steam jet requires high pressure steam and is expensive to operate. At present the most satisfactory device for hoisting ashes from the basement of an ordinary school is perhaps a large pail with a rope and pulley and a motor-driven drum for winding the rope. This motor may be installed as a part of the building equipment or it may be mounted on the truck body and the cord plugged in on the boiler room lights. This outfit must have a safety feature to prevent winding too far and to prevent falling. It has the advantages of simplicity and economy and is fairly satisfactory.

Questions.

1. What are the advantages of storing the coal for the whole season?
2. What has prevented the storage in most cities?
3. What is spontaneous combustion in a coal bunker?

4. What are the first indications of fire in a coal bunker?
5. Does escaping gas move upward or downward?
6. How can a hollow cone of fine coal hold gas?
7. What causes heat to generate in coal?
8. How does moisture affect spontaneous combustion?
9. How can the fire in a coal bin be extinguished by the custodian?
10. What is the best method of handling coal to the boiler?
11. What is most satisfactory means of removal of the ashes?

The Cost of Heat Losses from Bare Pipes.

Bare steam pipes have been preached against ever since the time of Watt, yet the bare pipe is still with us and losing money for its owner. Why aren't all pipes covered? Every steam pipe of any importance and size should certainly be covered unless it is a radiator pipe and is INTENDED to radiate heat, or unless it is an exhaust pipe, or something of that sort.

Perhaps the reason why owners are so slow to cover and insulate piping is because they regard the idea as being mostly "theory" and that in practice the actual money loss doesn't amount to much. Perhaps "money loss" hasn't been brought to the attention of the owner clearly enough—forcibly enough, and the reason why this has not been done is because we have not had enough information on the subject. We have not had a good reliable formula that would tell quickly how much money was being lost through heat in 10 hours, or in 100 hours.

In the 1915 Proceedings of the American Society of Mechanical Engineers, however, I find some good information on the subject. L. M. McMillan made some reliable and thorough tests by means of an electrical method and plotted his results in the form of a curve. I have used his results, therefore, in order to develop a trustworthy formula—a formula that will handle any ordinary case of heat loss from bare pipes. Then, with the formula as the basis I constructed the alignment chart which I show here. In using the chart it is not necessary to do any figuring. Simply lay a straight-edge across the chart four times as indicated by the dotted lines and the cost of the heat loss is immediately found in the right hand column.

This is the formula:

$$\text{Cost of lost heat in H hours} = \frac{(1.6 + .0056\ D)\ DHAC}{2000\ BE}$$

where D = the temperature difference in degrees F., or the pipe temperature minus the room temperature;
H = the number of hours during which heat is lost;
A = area of bare pipe in square feet;
C = cost of coal per ton of 2000 pounds, in dollars;
B = B. t. u. per pound of coal;
E = boiler efficiency.

For convenience I have used these same letters to designate their various columns in the chart. For example, take a case where we have these values:

C = $3.50
A = 100
D = 200
H = 200
B = 12,000
E = 60 per cent

What is the cost of the lost heat?

The dotted lines drawn across the chart show how the answer—$2.64—is obtained in column Y at the extreme right.

Connect C and A with line CA and locate the intersection with column X. Then connect D and H with line DH and locate the second intersection with column X. Now locate the midpoint M between these points of intersection and lay out the line BM HA, locating the intersection with column HA. Lastly, run a line through that point of intersection and the 60% (column E)—line HA E Y on the chart—and the final intersection with column Y gives the answer, $2.64.

By following this method any ordinary problem is easily solved. If the number of hours were 2000 instead of 200 the selfsame lines shown would be used and the decimal point would be moved one place to the right, making the cost $26.40 instead of $2.64. And if, in addition, the area were 1000 sq. ft. instead of 100 the decimal point would be moved one more place to the right, making the cost $264.00. The range of the chart is therefore decidedly wide. It includes temperature differences all the way from 13° F. to 500° F., all heat values for coal, and a boiler efficiency range from 10% to 100%. I

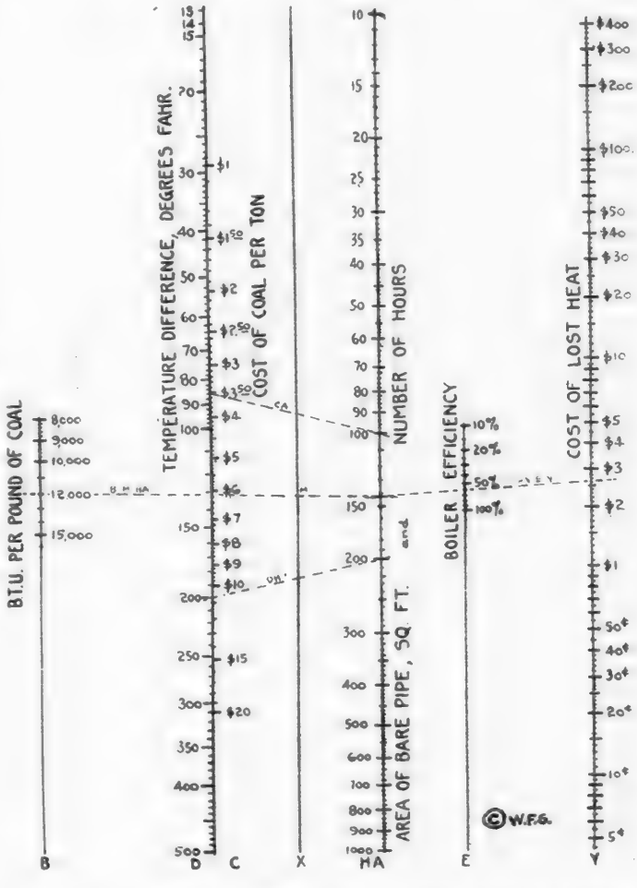

CHART FOR COMPUTING COST OF HEAT LOSSES FROM BAKE PIPES.

have included 100% efficiency because we are gradually "getting there." The recent record of 90% is very close to the point of desired perfection.

This chart therefore shows distinctly the money loss through bare pipes. Its aim is to influence the owner to cover those pipes. It is true that pipe covering will not save ALL of this money, but it will save much of it. The proportion of money saved depends entirely upon the efficiency of the covering. No covering made is 100 per cent efficient, but that efficiency is closely approached.

For example, let us cover the pipe solved above whose area is 1000 sq. ft. and which is heated for 2000 hours. Let us use a covering whose efficiency is 80 per cent. How much money would be saved in the 2,000 hours or 83.5 days. The answer is $264. × 0.80 = $211.00.

W. F. Schaphorst.

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FURTHER responses to our invitation for suggestions in the way of articles and topics have not only furnished many ideas which will be embodied in early issues of THE HEATING AND VENTILATING MAGAZINE, but have also demonstrated how large a fund of information has already been published in these columns on almost every phase of heating and ventilating work. In many cases, probably as many as 50%, it has been possible to supply the desired data by turning to previous issues, although this, of course, refers more particularly to basic data and not so much to their application. When it comes to the practice of the art, a little review work brings out very clearly the advances that have been made and the necessity of keeping in constant touch with the latest current literature on the subject. As one engineer expressed it not long ago, after having been out of touch with the trade for a couple of years, "It didn't take me as long as I expected to catch up." The point is, however, that he had to catch up.

As the suggestions received are worked out, many of them will form subjects of original contributions, while others will be handled by reprinting the data involved and supplementing this information with recent applications taken from actual practice.

To those not familiar with the routine of magazine making, it may not be amiss to state that some time must necessarily elapse before the more important articles, based on the suggestions sent in, can appear in print. Future issues are usually "laid out" some months in advance, to say nothing of the time required to prepare the articles themselves. It will be our pleasure, however, to arrange our schedule so as to incorporate, at as early a date as possible, the various suggestions received. We would also repeat last month's statement that it will be our purpose to answer every request for information either directly or through the reading columns.

TO show the range of the suggestions which have been sent in, the following are some of the more typical:

Arguments for and against air inlet at the bottom and vent at the top in fan blast heating and also for the reverse system; method of locating unit air heaters; methods of using smoke pots or bombs for determining air circulation in rooms; method of taking care of expansion in risers in very tall buildings; formulas and examples for figuring the amount of condensate or the amount of steam required to operate sterilizing equipment, cooking apparatus; use of superheated steam for air heating; cost of installing various types of heating systems, using some unit basis, etc.

Considering the number and character of the topics now in hand, our readers will understand our gratification in seeing the movement we have inaugurated meet with such a ready response, opening up an avenue of contact which will enable THE HEATING AND VENTILATING MAGAZINE to be of greater service than ever during the coming year.

REPORTS of the steps that are necessary to place business on its feet again in this country, and which invariably involve the importation of vast quantities of foreign-made goods to bring the exchange situation back to normal, are less disquieting to those engaged in the heating and ventilating industry than, perhaps, to those in any other field of activity. This is because foreign-made apparatus and appliances have never had wide application in American heating practice and probably never will. The remark sometimes heard that our heating and ventilating industry in "clannish" is only another way of saying that the art as developed in America is sufficient unto itself and in most respects, we may add, is considered in advance of that of other countries, at least with respect to its application. There is, admittedly, a lack of the refinements often found in European practice, but in the appliances themselves the industry has no need to fear European competition.

When one considers how difficult it is for a device of American origin to make its way, it is not hard to understands why foreign-made devices, with their peculiarities in the way of both design and manufacture, which are as characteristic and "different" as foreign hand-writing itself, are naturally "shied at" in this country, from the engineer down and vice versa.

During the war a correspondent of a New York paper, desiring to prove his patriotism and at the same time indulge in some subtle propaganda, wrote to declare that "my ancestors with the Mayflower over came." Foreign-made mechanical devices have equally distinguishing characteristics and so long as this is so, their chance for adoption by heating men in this country is hardly within the range of possibility.

W R I N K L E S

Using Standard Pipes as Columns or Struts.

Standard pipes often come in handy for use as columns or struts or for use as "push members" in transmitting forces. This is because a pipe is strong both in tension and compression. Due to its circular form it is ideal for resisting compressive forces.

However, when it comes to "figuring columns" it often takes considerable time digging around in handbooks, etc., and as a result the use of a pipe is avoided. Or, a pipe much too large or too small is used, chosen entirely by "guess." The pipe that is too small may fail and be the cause of disaster.

To assist those who may have occasion to use standard pipes in this way and to make it as easy as possible for them, the writer has developed the following simple table and rules:

1. Knowing the load that is to be carried and the length of pipe needed, make a "guess," as to the size of pipe. Column A in the tables will help in making the guess as it gives the maximum length of pipe that may be used. Thus, never use a ⅛ in. pipe, as an important column, longer than 14.5 in. Never use a 3 in. pipe, as an important column, longer than 139 in., etc.

2. Multiply the length of the pipe in inches by the corresponding figure in Column B of the table. This product should never be greater than 12,000. If it is greater than 12,000 it means that you have guessed a pipe that is too small. After getting the right size:

3. Subtract the product from 19,000. If the difference is equal to or less than 13,000 use it, in (4). If the difference is more than 13,000 use 13,000 in (4).

4. Multiply by the figure in Column C corresponding with the pipe size.

The result is the number of pounds that the pipe will carry as a column, strut, or "push member." If the result is less than the load to be carried, try again, using the next larger pipe size, and so on until the proper and most economical size is selected.

Size of Pipes Inches Diam.	Column A Maximum Length Inches	Column B	Column C
⅛	14.5	826.4	0.07
¼	19.4	617.3	0.12
⅜	25.	480.8	0.17
½	31.3	383.1	0.25
¾	40.	300.3	0.33
1	50.6	237.5	0.50
1¼	64.7	185.5	0.67
1½	75	160.5	0.80
2	94.7	126.9	1.07
2½	114	105.3	1.71
3	139	86.21	2.24
3½	161	74.63	2.68
4	181	66.23	3.18
4½	202	59.52	3.68
5	226	53.19	4.32

For example, it is desired to support a load of 10,000 lbs. at a height of 84 in. What size of pipe should be used? Following the rules we do this:

1. "Guessing" the size of pipe, Column A shows that 84 in. falls between 1½-in. and 2-in. pipe. We will therefore try a 2-in. pipe.

2. 84 × 126.9 = 10,650. This is less than 12,000 and we will therefore continue.

3. 19,000 — 10,650 = 8,350. This is less than 13,000 and we may therefore use it in (4). If the difference were 18,350 we would have to use 13,000 in (4).

4. 8,350 × 1.07 = 8,950 lbs.

Since 8,950 lbs. is less than 10,000 lbs. a 2-in. pipe is too small. We will therefore recalculate, this time trying a 2½-in. pipe.

2. 84 × 105.3 = 8,850
3. 19,000 — 8,850 = 10,150
4. 10,150 × 1.71 = 17,370 lbs.

This shows that a 2½-in. pipe would be amply safe to hold up 10,000 lbs. It shows that a 2½-in. pipe is capable of holding almost twice as much as a 2-in. pipe at a height of 84 in. The small difference in pipe sizes and the great difference in strength indicates the necessity of careful computation and the danger involved in guesswork.

W. F. SCHAPHORST, M. E.

Underground Fan Blast Heating of Railroad Round-Houses.

Probably the most difficult type of building to heat and ventilate is the engine house or railroad round-house. Some of the doors, and the front is all doors, must be open much of the time to allow for the comings and goings of engines and the increased length of modern locomotives.

For such buildings, the only way, or at least the usual way that heating and ventilation may be accomplished, is by the fan

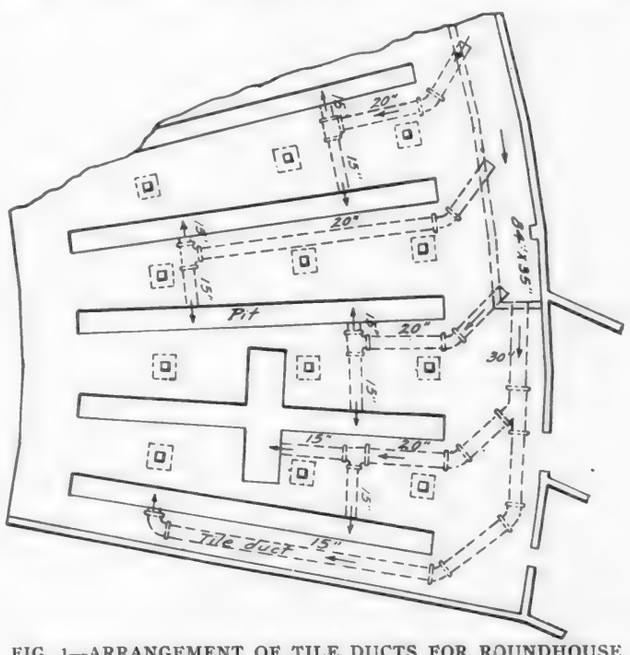


FIG. 1—ARRANGEMENT OF TILE DUCTS FOR ROUNDHOUSE HEATING SYSTEM.

blast method; the air being discharged through underground concrete ducts into the engine pits of the various stalls. In this way, the running gear of the locomotives is freed from snow and ice as is required for inspection, the resulting steam or vapor passing rapidly upward beyond the breathing zone and out of the smoke jacks, while the working level is maintained free of all objectionable gases.

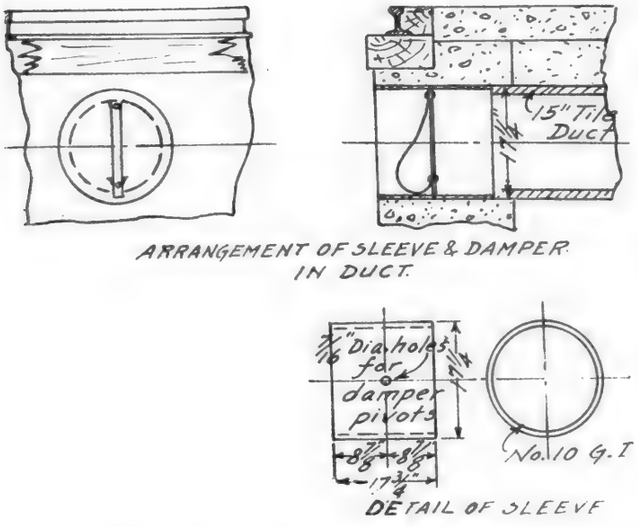

15" Tile Duct
ARRANGEMENT OF SLEEVE & DAMPER IN DUCT.
3/16" Dia. holes for damper pivots
No. 10 G. I
DETAIL OF SLEEVE
Pivots of 3/8" round iron flattened & drilled for 1/4" stove bolts
Handle of 3/8" iron flat at ends; bent as shown to act as stop
DETAIL of DAMPER.

FIG. 2—DETAILS OF SLEEVE AND DAMPER IN DUCT.

Ducts of smaller size, installed somewhat as shown in the plan view, are made of salt-glazed terra-cotta sewer pipe, with bell and spigot joints, one-half the joint caulked with oakum and finished with one-two cement mortar. Pipes, where not supported by building construction, should be placed on concrete saddles, one to each hub, the saddle resting upon concrete floors or platforms. A suitable damper should be installed in each outlet to be opened from inside the engine pit it supplies.

LEGAL DECISIONS

Extension and Abandonment of Heating Service.

An application to discontinue heating service to consumers who are connected with the distribution mains in the outlying districts of Mount Vernon, Illinois, by the Southern Illinois Light & Power Company, which owns and operates four utilities in that city for the supply of electric, gas, water and heating service, was opposed by consumers on the ground that central station heating service is a luxury which they wish to have continued, and that they are willing to pay increased rates within reason to permit of the continuance of the service.

The Illinois Public Utilities Commission is of opinion that a heating utility does not come in the same category as electric, water, or gas utilities when operating under the conditions prevailing in Mt. Vernon. This plant receives heat, for the most part, from the steam exhausted by the prime movers of the electric plant, and, due to the combined operation of the two utilities, certain advantages are enjoyed by each. It is appreciated that if the heating mains were extended, the heating load might be so great that the exhaust steam, available from the electrical generating units, would be comparatively small, and that the advantages of combined operation would be lost if the heating business was not confined to a definite area. From this standpoint, then, it would appear that the heating utility should not be required to extend its mains beyond a reasonable distance from the plant or into the residential districts where the amount of business served per unit of distribution main is relatively small. But the utility should not be permitted, while it is carrying on its heating business, to serve a portion of its customers and abandon the others, which it had taken on while operating under the franchise obtained from the city.

Necessity for Increase of Rates.

In 1917 the Yakima Central Heating Company was, and had been for a number of years, engaged in the business of furnishing steam heat to buildings in the business district of the city of Yakima, Washington. It owned a steam heating plant, consisting of boilers and other equipment, and owned the conduits leading from the plant to the places of use, but did not itself generate the steam heat it used. This was generated by another corporation, under a contract at certain fixed rates, which contract had at the time named a number of years to run. The company made a proposition to an owner contemplating the erection of an apartment building to furnish it with steam heat. The proposition was in the form of a letter, proposing to supply steam for heating the building and for heating water for an eight-month season at $1,500 per season, on a five-year contract, providing that the system should be installed according to the plans and specifications drawn by the Yakima company. There was no acceptance in writing of the proposition, nor was there any written contract entered into between the parties embodying its terms. The owner, however, proceeded with the construction of the building. It employed a Mr. Bradley to furnish and install the steam pipes and radiators necessary to heat the building, and directed him to consult with the heating company as to the plans and specifications for the heating appliances required. Following these instructions, Mr. Bradley collaborated with the heating company's representatives, and they together determined upon the necessary installation, drawing outline plans therefor. No formal specifications were drawn, although, seemingly, certain matters which might have been proper in specifications were delineated on the plans. The heating appliances were installed as the building progressed, and during the course of the work it was inspected from time to time by the heating company's representatives. The recommendations of these representatives were not followed implicitly, however, by Mr. Bradley. In certain places piping of a larger size and in other places piping of a smaller size than that recommended was installed. The plant as installed was so designed as to be readily converted into a private heating plant, and there was nothing special or unusual in its design; it was such a plant as is usually installed in buildings of the kind.

After the installation of the plant the heating company connected its mains therewith and furnished the necessary steam for heat until the close of the heating season of 1918, charging therefor at the rate named in its written proposal. At that time it notified the owner that it would not continue furnishing heat for the building except at an increased rate—the current rate paid by other consumers. The owner sued for a mandatory injunction requiring performance of the contract.

There was a dispute in the evidence introduced on the question whether there was a formal acceptance of the pro-

posal. The manager of the heating plant testified that he verbally accepted the order on his company's behalf in April, 1917. On the other hand, the heating company's representative testified that there was no acceptance of the offer whatsoever; that, on the contrary, some time late in the summer of 1917, he notified the owner's manager that the company would be unable to furnish heat in conformity with the proposal for the period specified; that it would do so as long as it could obtain steam from the corporation which was then supplying it at the rate of its existing contract, but if the rates were raised to it it would be compelled to raise the rates to its consumers correspondingly; and that the owner assented to this new proposal. He testified further that the flat rate offered was based on the company's meter rates and was substantially the then prevailing rate charged its consumers generally. There was further evidence to the effect that the company generating the steam for the heating company later refused to continue in the performance of its contract and refused to generate heat unless there was a readjustment of rates; the reason given being that war conditions so increased the cost of production that it could not proceed further without bankruptcy. From a judgment for the plaintiff the heating company appealed.

The Washington Supreme Court, Cahalan Investment Co. v. Yakima Central Heating Co., 193 Pac. 210, ruled that the evidence was insufficient to warrant a decree of specific performance: First, Because it is a general rule that such a decree will not be granted unless the evidence of the making of the contract is clear and convincing, and the court was not persuaded that the evidence here satisfied the rule. Second, A court of equity is always loath to specifically enforce a contract the enforcement of which requires the subsequent supervision and direction of the court, especially so where the contract extends over a considerable period of time. Here the period of time for which this supervision must continue, according to the decree, as entered, was three years. Many differences were bound to arise between the parties during that time over the question whether the contract was being properly performed, to settle which would require investigations and orders on the part of the court, and it could involve the taking by the court of complete control of the heating company's business through the instrumentality of a receiver. To conduct a private business is not the function of a court of equity. Third. A court of equity will not ordinarily specifically enforce the performance of a private contract where the aggrieved party has an adequate remedy at law. Here the court thought there was such an adequate remedy, and that the owner could maintain an action at law for a breach of contract. The decree was accordingly reversed, with instructions to render a decree for the heating company.

Prospects for Oil and Gas as Fuels of the Future

In a paper read before the Western Society of Engineers, Professor S. W. Parr, of the University of Illinois, gives an optimistic view of the future possibilities of oil and gas as fuels. His article starts off with a brief sketch of the progress from wood to oil fuel, and he eagerly makes the suggestion that the quality of mobility—ease of handling and transportation—will become a leading requirement of future fuels.

This quality is possessed by both oil and gas fuels and it is Professor Parr's belief that one or other of these will be the ultimate fuel. As an example of the importance of mobility, is cited the tremendous growth of the automobile, which is not entirely due to the automobile habit but in a large measure also to the fact that gasoline provides energy in a compact and mobile form. A further example introduced is that of the Diesel-engined ship which carries its fuel in space that would be otherwise wasted, carries a smaller volume of fuel, burns the fuel with but a fraction of the cost of stoking coal, and has both a larger cargo space and a greater steaming radius than the coal-burning vessel.

Professor Parr sees for the future an increase in the use of oil fuel for vessels and of gasoline, or gasoline mixtures with benzol and alcohol, for automobiles and similar automotive vehicles. This latter necessitates, however, greater perfection of the processes of gasoline production, so that a larger percentage of the crude oil will become available as gasoline. Similarly optimistic is his view of the future of gas as a fuel, but this is also held to depend upon improvement of the processes of gas production, so that the heat content per cubic foot of gas can be increased without an increase in the price of the gas. The advantage of this use of gas instead of coal fuel, lies not only in the greater convenience and cleanliness possible, but in the fact that it permits the recovery of valuable chemical by-products destroyed in the burning of raw coal as fuel. Another line along which lies chance for improvement, is in the partial distillation of bituminous coal by which can be removed the volatile, smoke-producing elements, leaving a coal more nearly anthracitic in its combustion characteristics and yielding a worth-while amount of oil, about half a barrel to the ton.

Proper Construction and Use of Open Fire Places.

There are various points bearing upon the construction of fireplaces which are not always fully understood. Difficulties will ensue if the installation is not governed by certain rules, such as those for proper proportions of flue to opening and correct fashioning of throat and smoke chamber. Fireplace depths should be 15 in. preferably 20 in., those of very large size 24 in. Greater depth is unnecessary nor should the opening be greater than 30 in. in height, except for very wide fireplaces.

In Fig. 1, the splayed jambs and a sloping back project the heat into the room and the resulting narrow throat forms

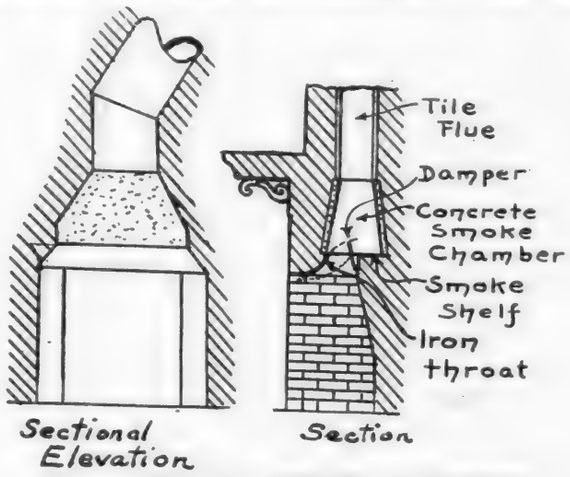


FIG. 1—FIREPLACE DESIGNED TO PREVENT DOWN DRAFTS.

a shelf as a wind break to prevent downdrafts. The reverse currents, coming in contact with this shelf reverse again and are carried upward. Down-draft as caused by adjacent buildings or trees may also be eliminated by installing a cap at the top of the chimney, as shown in Fig. 2.

The throat is the point where the fireplace contracts just above the arch. One improperly shaped hinders the passage of smoke, even with a good draft. At this point the damper should be located to shut off down-drafts and control ventilation. A throat of cast-iron is smooth, giving an easy turn for the passage of gases, one of masonry is not and is difficult to construct for equal smoothness.

The cast-iron throat as a strong lintel supports the masonry

of the chimney. It also increases the velocity of the smoke and gases, projecting them into a smoke chamber. The latter should be of concrete, finished smooth, without square angles and shoulders, and having an area of gradual reduction to point of connection with tile flue. The tile flue should have a minimum of 4-in. brickwork laid in cement mortar, with 8-in.

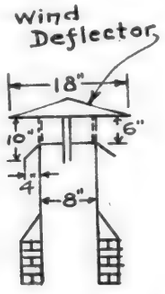


FIG. 2—USE OF CAP AT TOP OF CHIMNEY TO PREVENT DOWN DRAFTS.

brickwork in outside exposed lining. Finally, to prevent smoke and a one-sided fire, draw in the smoke chamber to the center and make any necessary turns above this point.

To prevent smoke when starting the fire there is required some material which will burn with rapid combustion, such as newspapers or shavings, after which the main fire is built up.

Its use as an economy is, of course, limited to such times as when a little heat is required for a short period.

Steel Pipe Versus Cast-Iron Pipe.

Much can be said in favor of steel pipe made in accordance with modern inexpensive manufacturing methods. The prevalent opinion seems to be that cast iron pipe costs less than steel pipe, but that is not always true. There are certain makes of steel pipe the first cost of which is less.

Cast iron piping is objectionable, for instance, for use in overhead structures, where it would have to be supported by columns at every joint, because the joints cannot withstand bending and bolts would require expensive machining, making the cast iron pipe still more costly. Steel pipe as now made can be bolted together at the joints and requires few and inexpensive supporting members. Besides, if necessary, the steel pipe can be bent—an impossibility with cast iron pipe. There is also to be considered the cost of erection work which is far less for steel pipe than for cast iron pipe.

Altogether therefore the advantage seems to lie with the

IMPORTANT ADVANTAGE OF CAST-IRON PIPE.

Cast iron pipe has one very important advantage in its great durability. It can be placed in the ground and covered up and will last almost indefinitely. Steel pipe must be carefully coated when exposed either to the atmosphere or when used underground.

W. F. SCHAPHORST.

FINDINGS AND RECOMMENDATIONS OF THE NATIONAL CONFERENCE ON UNEMPLOYMENT

Now that the National Conference on Unemployment has met and adjourned, it is in order to note some of the net results of this important meeting. Out of the mass of testimony presented and the suggestions offered, it is only possible to pick out a few of the salient facts bearing on the problem and to give the principal remedies suggested.

To institute measures for immediate relief the sentiment of the conference was for action first on the part of municipalities and both the smaller and larger cities were urged to formulate plans at the earliest possible moment to take what action was possible in placing the unemployed at work in their immediate sections.

Under the heading of "General Recommendations for Measures for Permanent Recovery of Unemployment," the conference presented the following summary of the more important matters that require constructive and immediate settlement:

1. Readjustment of railway rates to a fairer basis of the relative value of commodities, with special consideration of the rates upon primary commodities, at the same time safeguarding the financial stability of the railways.

2. Speedy completion of the tax bill with its contemplated reduction of taxes, in order that business now held back pending definite determination may proceed.

3. Definite settlement of tariff legislation in order that business may determine its future conduct and policies.

4. Settlement of the financial relationships between the Government and the railways, having in mind the immediate necessity for increased maintenance and betterments, making effective increased railway employment and stimulation of general employment, in order that the railways may be prepared for enlarged business as it comes.

5. Limitation of world armament and consequent increase of tranquility and further decrease of the tax burden not only of the United States but of other countries.

6. Steps looking to the minimizing of fluctuations in exchange, because recovery from the great slump in exports (due to the economic situation in Europe) can not make substantial progress so long as extravagant daily fluctuations continue in foreign exchange, for no merchant can determine the delivery cost of any international shipment.

7. Definite programs of action that will lead to elimination of waste and more regular employment in seasonal and intermittent industries, notably in the coal industry, in order that the drain upon capital may be lessened and the annual income of workers may be increased.

8. In the field of all the different industries and occupations the rapidity of recovery will depend greatly upon the speed of proportionate adjustment of the inequalities in deflation. A table is attached (here presented in abstract) drawn from various sources, showing the percentage of present levels above the levels of the same commodities and services of the pre-war period. It will be observed that agriculture has reached an unduly low plane, while transportation, coal, and some branches of the construction industries are of the highest. It will also be observed that there is an entire disproportion between the price of the primary commodities and the ultimate retail price. These disproportionate increases in the progressive stages of distribution are due to increased costs of transportation, enlarged profits, interest, taxes, labor, and other charges.

If the buying power of the different elements of the community is to be restored, then these levels must reach nearer a relative plane. For example, the farmer can not resume his full consuming power and thus give increased employment to the other industries until either his prices increase or until more of the other products and services come into fair balance with his commodities, and therefore within reach of his income.

APPROXIMATE INDEX NUMBERS BASED UPON 100 FOR 1913.

	August, 1921.
Cost of living:	
Department of Labor (May Survey)	180
National Industrial Conference Board	165
Average price to producer, farm crops	109
Average price to producer, live stock	113
Average wholesale price, foods	152
Average retail price, foods	155
Wheat and flour:	
Wheat average to producer	128
Flour, wholesale, U. S. average	173
Bread, retail, U. S. average	173
Freight rate flour, Minneapolis to New York, domestic	187
Live stock and meats:	
Wages in meat packing (Department of Labor investigation)	186
Freight rates, dressed beef, Chicago to New York	214
Hides and leathers:	
Hides, green salted, packers, heavy native steers (Chicago)	76

Hides, calfskin No. 1, country, 8 to 15 lbs. (Chicago) 86
Leather, sole, hemlock, middle No. 1 (Boston) 120
Leather, chrome, calf, dull or bright, "B" grades (Boston)... 195
Wholesale boots and shoes, men's vici calf, blucher-Campella (Brockton) 225
Freight rate shoes, Lynn, Mass., to Chicago 210
Wage scales in shoe industry (Massachusetts), about 200
Cotton:
To producer 105
Wool:
To producer 92
Wholesale worsted yarns 2/32, crossbred stock white in skein (Philadelphia) 148
Wholesale women's dress goods, storm serge, all wool, double warp, 50 in. (New York)..... 157
Wholesale suitings, wool-dyed blue, 55-56, 16 oz., Middlesex (Boston). 183
Freight rate clothing, New York to Chicago 210
Wage scale in mills, about 200
Building and construction:
Prices—
Lumber, average southern pine and Douglas fir (at the mill) 128
Brick, average common, New York, and Chicago..... 199
Cement, Portland, net, without bags to trade f. o. b. plank (Buffington, Ind.) 175
Freight rates—
Brick common, Brazil, Ind., to Cleveland, Ohio..... 204
Cement, Universal, Pa., to New York 179
Building labor:
Union scale, simple average, 15 occupations 190
Union scale, weighted average, 8 occupations, frame houses (3) 197
Union scale, weighted average, 8 occupations, brick housse (3)... 193
Common labor 130
Construction costs: Cement buildings (Aberthaw Const. Co.)..... 161
Coal:
Price, bituminous, Pittsburgh..... 186
Price, anthracite, New York tidewater 198
Union wage scales about..... 173
Non-union scale, about..... 136
Freight rates 187-209
Metal trades, union wage scale: Simple average, 19 occupations..... 218
Metals:
Prices—
Pig iron, foundry No. 2 Northern (Pittsburgh) 137
Pig iron, Bessemer 128
Steel billets, Bessemer (Pittsburgh) 115
Copper, ingots electrolytic, early delivery, New York..... 75
Lead, pig, desilverized, for early delivery, New York..... 100
Zinc, pig (spelter), Western, early delivery, New York.... 80
Day labor, scale U. S. Steel Corporation 150
Printing and publishing:
Book and job, union wage scale... 194
Newspaper, union wage scale..... 157
Railroad, average receipts per ton-mile 177
Bureau Railway Economies estimate of railway wages based on average annual compensation, third quarter 226
General estimate all union wage scales by Prof. Wolman..... 189

Note—The wage indexes refer mostly to wage scales, not the earnings which necessarily also depend upon regularity of employment.

STATUS OF THE BUILDING AND CONSTRUCTION INDUSTRIES.

Probably the report of the most direct interest to those engaged in the heating and ventilating field was that of the Committee on Construction. After calling attention to the fact that the public in this field had not had confidence in the stability of values and have not been able to determine if and when the cost of construction reached a point warranting their investment, the report declares that a return of confidence in values in construction will assure more employment than in any other area. Considering all branches of the construction industry more than 2,000,000 people, states the committee, could be employed if construction would be resumed.

"There are three outstanding factors in the building and construction situation," continues the report, "which have the greatest bearing on the resumption of construction activities. They are financing, material costs and labor costs. These factors present questions which cannot be settled in a national way; they must be investigated by those interested, in each community for itself. The questions are:

"(a) Can the prospector investor finance the operation at a reasonable cost?

"(b) Does the cost of construction materials to the prospective investor properly represent the reduction which has been made in the wholesale prices?

"(c) Is labor in the particular locality working at fair rates and giving fair values in the quantity and quality of work done?"

Taking up material costs, the report says:

"Many construction materials have been substantially reduced. Some may have been reduced to a point which is retarding production. It is apparent, however, that other construction materials have not yet been reduced in keeping with the trend of wholesale prices on other commodities. Manufacturers of such materials should be urged to promptly make their readjustments to a reasonable basis. They must realize that failure on their part to do so is not only limiting their own business but it is also interfering with the production and sale of other construction materials; it is interfering with greater employment; in a word, it is a contributing factor to holding back the progress of the entire industry.

"In many instances retailers of construction materials have not yet followed the reduction of manufacturers and wholesalers in their resale prices. This is an important subject to be taken up locally in each community. The retailers must be shown the necessity of bringing their prices to local buyers down to a point consistent with the reductions made in wholesale prices after taking into consideration increases in freight rates or legitimate increases in cost which exist in other directions."

The report also went into labor costs and then went into the subject of unfair practices. On this subject the report said:

UNFAIR PRACTICES.

"Notwithstanding the improvements which have taken place in some instances, with respect to the practices in the industry, it is apparent that there still exist trade abuses, waste, and unnecessary expense. It is a first essential of the proper development of the construction industry on a sound basis that all practices which unnecessarily retard the work or add to its cost should be immediately discountenanced and abandoned, if the confidence of the public is to be fully restored.

"There are certain restrictions or limitations which were placed upon the industry during, and since the War, which should be removed."

APPOINTMENT OF COMMITTEE ON CONSTRUCTION DEVELOPMENT RECOMMENDED.

The report concluded with the recommendation that Secretary Hoover appoint a committee selected from the various elements interested in construction, such as financiers, labor, engineers, architects, contractors, material manufacturers and others, to be known as the Committee on Construction Development, which will undertake to prepare and make effective plans for—

(a) Co-operation with the governors and mayors in the several States in carrying on community conferences on construction, to the end that local restrictions may be eliminated, abuses done away with, and proper local attention given to the efficient planning and development of construction work, as it is only through such community conferences that the local situation can be properly appraised.

"(b) The prompt removal of unnecessary or inequitable limitations and restrictions which have retarded real construction activity."

It is a matter of interest to know that the membership of the National Conference on Unemployment, which was headed by Secretary Herbert Hoover of the Department of Commerce, included President Joseph H. Defrees of the Chamber of Commerce of the United States, and President William J. Woo'ley, of the American Radiator Company.

Analysis of Building Material Costs.

The charge that heating contractors are still making excessive bids is well met by an analysis of building material costs made by Frank H. Meadows of the National Association of Heating and Piping Contractors, and published in a recent number of the Association's *Official Bulletin*. In the accompanying table is shown a digest of Mr. Meadows's

COMPARISON BETWEEN MATERIAL COSTS AND CONTRACT PRICES.

Items	Low	Advance	Peak	Drop	Now	Percent Above Low
2-in. Black Pipe	8.65	15.43	24.08	6.13	17.95	108
Cast Iron Fittings	.27	.90	1.17	.41	.76	250
Brass Gate Valves	.31½	.63½	.95	.30	.65	106
Iron Body Gate Valves	.30	.60	.90	.18	.72	140
Water Boilers	.37	.39	.76	.15	.61	65
Water Radiation	16.80	31.36	48.16	18.27	29.89	78
Radiator Valves	.13	.37	.50	.10	.40	208
Contract Prices per Sq. Ft. Radiation	.62	1.23	1.85	.62	1.23	98

findings, comparing the costs of heating materials and equipment with contract prices in that line for the period from 1914 to 1921 inclusive.

Chicago Trade Adopts New Form of Agreement.

Unusual interest attaches to the uniform agreement form which has been developed by the joint conference board of the Chicago Building Construction Employers' Association and the Chicago Building Trades Council. The fact that it has been approved by the umpire, Judge Kenesaw M. Landis, lends added weight to its terms. The folder containing the form of agreement also contains some standard working rules approved by the umpire and made a part of the agreement. The principal sections of the new form are given herewith:

Article 1. This agreement made this .....day of ..... by and between ..... of Chicago, Ill., party of the first part and the ..... of Chicago, Ill., party of the second part, for the purpose of preventing strikes and lockouts and facilitating a peaceful adjustment for all grievances and disputes which may from time to time arise between the employer and the employee in this trade and for the purpose of preventing other waste and unnecessary and avoidable expense, annoyance or delays, making building costs as low, stable and certain as possible consistent with fair wage rates and for the advancement of labor and management in skill and productivity.

"2. Witnesseth: That both parties hereby agree that there shall be no strikes, lockouts or stoppage of work and that they will by all lawful means compel their members to comply with the arbitration agreement and working rules as jointly agreed upon and adopted and that where a member or members affiliated with either of the two parties to this agreement refuse to do so, they shall be suspended from membership in the association or union to which they belong.

"3. Principles upon which this agreement is based: Both parties hereto this day hereby adopt the following principles as an absolute basis for their joint agreement and working rules and to govern the action of the Joint Arbitration Board as hereinafter provided for in all matters which may come before said Board and any decision, agreements or working rules contrary in word or effect to the following eight principles or other clauses in this agreement shall be null and void:

I. That there shall be no limitations as to the amount of work a man shall perform during his working day.

II. That there shall be no restriction of the use of machinery, tools or appliances.

III. That there shall be no restriction of the use of any raw or manufactured material, except prison made.

IV. That no person shall have the right to interfere with workmen during working hours.

V. That the use of apprentices shall not be prohibited.

VI. That the foreman shall be the agent of the employer.

VII. That workmen are at liberty to work for whomever they see fit, but that they shall demand and receive the wages agreed upon by the Joint Arbitration Board in this trade under all circumstances.

VIII. The employers are at liberty to employ and discharge whomsoever they see fit."

An arbitration committee is provided for, the members of which must be engaged in the trade covered by the agreement. An umpire, however, is to be selected who is in nowise affiliated with the trade in question, or who is occupying an elective public office.

Any unsettled dispute, as one which might fail to be decided by the umpire through his inability to serve, is to be referred to a joint conference board created under the terms of the joint agreement between the Building Construction Employers' Association of Chicago and the Chicago Building Trades Council. There is the provision for an appeal on all jurisdictional matters to the National Board for Jurisdictional Awards whose decisions and rules shall be final.

In defining the powers of the Joint Arbitration Board it is stated that this board shall have full power to enforce the agreement and make and enforce all lawful working rules governing both parties. No strikes or lockouts shall be resorted to, and work shall continue pending the decision of the Joint Arbitration Board, or the Joint Conference Board or the National Board for Jurisdictional Awards.

Other sections provide for time of meeting, rules of procedure, power to summon members, salary, and stoppage of work and penalties, as well as collection of penalties and suspensions.

No member, it is provided, shall leave their work because non-union men in some other line or work or trade are employed on the building or job, or because non-union men in other lines are employed on any other building or job, or stop work under construction for members affiliated with the employers, except as provided for in the agreement, under penalty of a fine of not more than $25.00 for each member. Other fines are provided for violations of the agreement, although it is stipulated that "nothing in this agreement shall interfere with the right of the men to refuse to work for the employers when employed by any person or firm having building construction work done in Cook County by parties not affiliated with the workmen.

In case of abandonment of work, either by concerted or separate movement, will be considered a breach of the agreement unless the workmen who quit furnish, within 24 hours, an equal number of competent men. In case of failure to do this, the rules and procedure governing scarcity of help shall apply.

The clause on scarcity of help reads that if after 48-hours' notice to the workmen, they are not able to furnish to all members of the contracting interests represented a required number of mechanics, then the employers are entitled to procure the men required. Such men must be affiliated with international unions associated with those of the workmen who are parties to the agreement. On further failure after 48 hours' notice to obtain mechanics so affiliated, the employers may take on such men as they may be able to procure and permits must be immediately issued to such men.

On the subject of overtime, it is provided that " there shall be no overtime work except of an emergency nature to preserve life and property, except on proper approval. Regarding the right to strike, the agreement reads that nothing shall be construed to interfere with the rights of the officials of the unions from stopping work for the purpose of collecting wages due the members, or in case of a wage dispute, until the matter has been referred by one party or the Joint Arbitation Board for an adjustment.

Unaffiliated contractors may secure the benefits of membership by paying a stipulated fee and dues, and 2/10 of 1% on the gross amount of work done in Cook County.

Essential Qualities for Engineering Success.

In a recent address before the Los Angeles Chapter of the American Association of Engineers, Professor J. H. Montgomery of the University of Southern California outlined his view of the qualities that make for success in the engineering profession. The first and fundamental quality he believes to be a keen interest in the solution of difficult problems, the discovery and application of natural laws to that end. Second of the qualities of a successful engineer in his estimation is a thorough knowledge of mathematics. The third essential proposed by Professor Montgomery is detailed knowledge of some special branch in which the individual is particularly interested, since no one can be familiar in this way with the whole engineering field. Fifth on his list of requirements is practical experience in the chosen branch of engineering. The ability to write and talk on engineering matters in an accurate and grammatical way is offered as the sixth essential. And the last but not the least requirement for engineering success is given as the possession of sound social and moral ideals.

TYPES OF WATER SERVICE HEATERS

III.

BY C. M. HARDIN,

Ross Heater & Manufacturing Company.

The general demand for efficiency has become acute as the need is great, being decidedly greater to-day than it was five years ago. It extends to every phase and channel of industrial and commercial activity. The heating and ventilating industry is no exception. Within and allied to this field, all its construction and manufactured materials must be, and are sufficient in design and workmanship, and efficient in performance.

The engineering involved in the selection of a water service heater demands thorough investigation into capacity and economic requirements, to determine the size and type, instantaneous or storage, that best fits the need.

The selection is not always a simple matter because with a great many applications there are no sharp defining lines and thoughtful analytical judgment is needed to make the correct choice.

The general characteristics which dictate the usage of storage heaters are: sudden and large peak demands, intermittent or fluctuating steam supply, or even a constant steady steam supply less than that necessary for the maximum heating conditions. The general characteristic that dictates the usage of instantaneous heaters is steady demand, with a corresponding uniform steam supply.

INSTANTANEOUS TYPE MORE EFFICIENT THAN STORAGE TYPE.

The instantaneous type is inherently more efficient than the storage. To heat the same quantity of water through the same temperature range requires approximately two and one-half times the heating surface for the storage heater as for the instantaneous, since the heat transfer between steam and water is approximately two and one-half times as great with water inside the tubes (instantaneous heater) as with steam inside the tubes (storage heater).

Because of its greater inherent efficiency the instantaneous heater has a broader economic field than may appear before a thorough analysis has been made. The demand may fluctuate over a wide range and the instantaneous be the proper type to use, even up to the point of having heating capacity several times that needed for the normal or average demand. For exceptionally heavy peaks a combination to be given serious thought is an instantaneous heater of generous proportions operating in series with a separate storage tank.

Furthermore, because of this greater inherent efficiency, the instantaneous heater responds more quickly to a fluctuating load requirement, and should be used when it is essential to maintain a fixed delivery temperature.

If a heater either of the instantaneous or storage type is operated with exhaust steam and the demand should increase above the heating capacity or the supply of steam should fail or drop below the demand, supplementary live steam may be admitted either through a thermostatically-operated valve, as is commonly used, or by means of an automatic constant-pressure valve. The operation of this latter valve is: as the supply becomes inadequate the pressure drops, automatically opening the valve, admitting live steam until the supply tends to exceed the demand, whereupon the steam pressure increases, automatically closing the valve, shutting off the live steam.

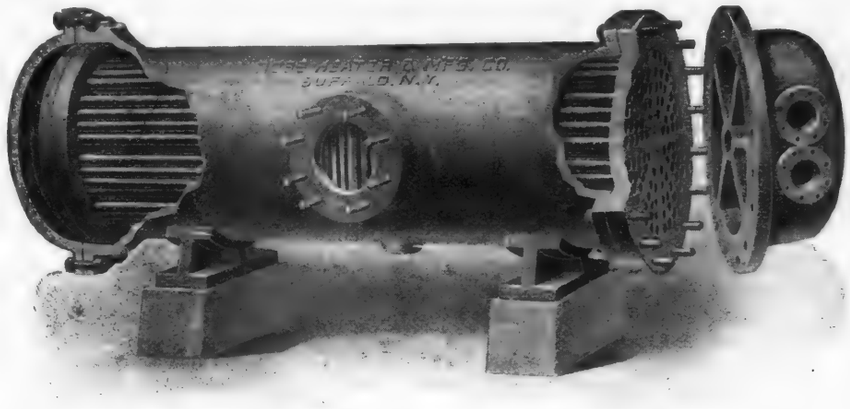


FIG. 1—ROSS STANDARD INSTANTANEOUS WATER HEATER.

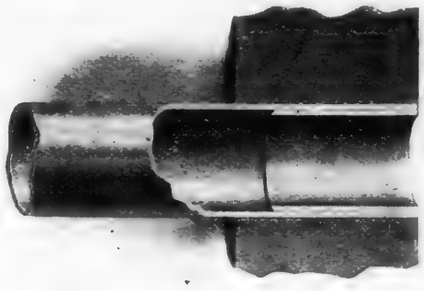


FIG. 2—METHOD OF INSTALLING AND REINFORCING TUBES

Referring to the product of the Ross Heater & Manufacturing Co., of Buffalo, N. Y., to which the present article is devoted, the Ross standard instantaneous heater (Fig. 1) is cast-iron with the exception of the tubes and tube plates Rolled-steel tube plates are used unless brass or some other composition metal better suits. Rolled steel is more serviceable than cast-iron because of its greater toughness and homogeneous quality. Smooth, straight tubes are used, generally copper or brass, preferably copper because of their greater ductility and freedom from splitting, especially when subjected to high temperatures. Size and guage depend upon specific conditions, although ¾ in. O. D. is ordinarily used.

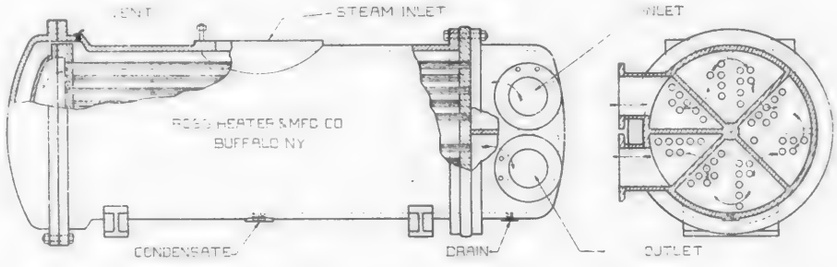


FIG. 3—BONNET CONSTRUCTION OF FLOATING HEAD END.

The tubes are expanded into a stationary tube head at one end and into a floating tube head at the other end. The expansion and contraction is satisfactorily taken care of by the floating head. The method used of installing the tubes is designed to insure their tightness. A brass reinforcing ferrule of snug fit is placed in the end of the tube (Fig. 2). The tube and ferrule are carefully and thoroughly rolled throughout the length of the reinforcing ferrule with parallel expanding rollers.

The bonnet construction of the floating head end (Fig. 3) obviates the necessity of a stuffing box. Symmetrical partitions in the bonnet divide it into sections for the required number of passes. The number of passes is principally determined by the temperature range contingent somewhat upon the permissible pressure drop through the heater. Radial steam passages and a baffle at the inlet of the heater distribute the steam over the entire heating surface.

ADVANTAGE OF SMOOTH, STRAIGHT TUBES IN ELIMINATING SCALE.

In a large number of cases the water and steam used in heaters precipitate a deposit of scale which if allowed to accumulate in or on the tubes will materially lower the heat transfer and efficiency, and will also reduce the heating capacity. Smooth, straight tubes are most readily and easily cleaned. Also in case a tube should fail it can be removed and replaced without interfering with any other tube. In fact, the whole heater is built up of simple parts, machined, and all holes drilled from steel templates providing easy accessibility for inspection, cleaning and repairs.

The Ross storage heater, (Fig. 4), consists of a steel tank, heating element and steam chest. The materials and design construction of the heating element are similar to those of the instantaneous heater. The tubes are expanded into a stationary tube head at one end and into a floating tube head at the other end. The steam chest is cast-iron and bolted to the tank nozzle with through bolts so as to be easily disconnected to inspect or clean the heating element or remove it for repairs. With long tubes one or more intermediate cast-iron supporting plates are used to give them proper alignment and stability. The floating-tube head is held in position by a circularly formed strap fastened to the tank.

An additional or supplementary heating element for heavy peak demands may be put in the top of the storage tank. Relatively small over-loads or a deficiency of the normal exhaust steam supply may be taken care of by automatically admitting supplementary livesteam to the single heating element, as described earlier in the article.

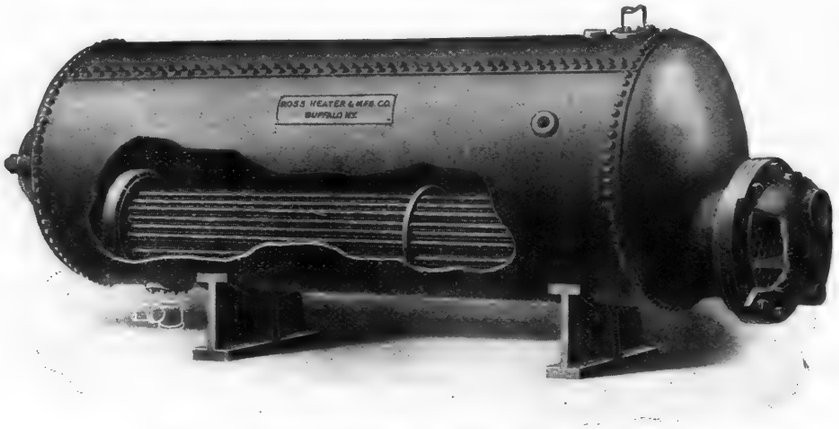


FIG. 4—CONSTRUCTION OF ROSS STORAGE HEATER.

New Record Set in Size of Heating Boiler.

An idea of the sizes of boilers that are being used in central station heating work, for generating steam exclusively for heating purposes, is given in the installation of a saturated-steam boiler unit having 29,820 sq. ft. of steam-making surface, which is being installed in the Congress Street heating plant of the Detroit Edison Company. This is one of the four boiler plants that supply steam for heating buildings in the central business and residence district of the city. The boiler is of the Connelly type. It has four upper drums 44 in. in diameter and two mud drums 48 in. There are 2,184 tubes arranged in banks 52 tubes wide in the direction of the length of tubes. It contains no less than 29,820 sq. ft. of heating surface.

The height to the extreme peak of the combustion chamber is 35 ft. and the volume of the combustion chamber, from the tubes to the top of the stoker tuyeres is 11,440 cu. ft., which reduces to 0.383 cu. ft. per square foot of heating surface. As the boiler is double ended it is equipped with two underfeed stokers, three-plunger type, each having 14 retorts. The rated capacity is 1200 to 1400 lbs. of coal per retort per hour, giving a total fuel-burning capacity of 33,600 to 39,200 lbs. of coal per hour.

The boiler is designed for a working pressure of 160 lbs. gauge but will be operated at present at 125 lbs. pressure and, at times, as low as 75 lbs., depending upon weather conditions.

Average Home Builder May Safely Build Now.

In the opinion of Franklin T. Miller, formerly director of the Division of Public Works and Construction Developments of the United States Department of Labor, and later assistant to the Special Committee of the Senate Committee on Production and Reconstruction, as reported in the *American Contractor*, "if the buyer can secure his materials at a rate not more than 60% above the pre-war level, I am inclined to believe that he faces no unusual hazard in building now, assuming that labor restrictions in his locality are not unreasonable.

"My reasons for this belief," he adds, "are that this is still a buyers' market and the buyer can now select his labor from the present ample supply, he can get his materials in the quality and quantity he desires and he can obtain adequate transportation service."

Mr. Miller mentions four factors which go far towards controllng the situation: (1) present and future rents, (2) the present and future purchasing power of the dollar, (3) the future trend of prices and (4) the effect of European conditions. Rents, he holds, will continue above the pre-war level for several years. The purchasing power of the dollar, which is now below the pre-war standard, will improve only as we re-establish the pre-war ratio between money and credits on one hand and goods on the other. The general trend of prices, he feels, will be downward with periodical reactions. Finally European conditions must improve so that the European markets can absorb our surplus of manufactured products before the price level in the United States will reflect the economies and lower producing costs possible only where we make the maximum use of our producing facilities.

In answer to the question as to how long it will take Europe to restore her purchasing power to where it was prior to 1914, Mr. Miller's answer is longer than he expects to live and yet he notes that every reputable authority on economics is agreed that this purchasing power and a resumption of normal business relations with Europe are conditions precedent to the lowest possible price level in this country.

Educational Courses Established in Industrial Publishing.

The Business Training Corporation has been retained by the New York Business Publishers' Association to conduct courses in Business Publishing under the direction of the Educational Committee of that body by which these courses were organized. For resident students the instruction course will include lectures, conferences, text books, problems, and a personal commenting service. A parallel correspondence course will also be given, including all features except those of personal instruction.

Among the topics to be covered in this course are: distinctive features of industrial publishing; its code of ethics; personal qualities required for success; determining editorial policies; getting the right kind of articles; securing accurate reports and data; writing for industrial papers; building up circulation; creating advertising; departmental management; service to the industry; service to advertisers; basic policies and tendencies. The fifteen text books to be used in this course have been prepared by H. H. Norris, managing editor of the Electric Railway Journal and formerly head of the Department of Electrical Engineering at Cornell University.

While the course is designed primarily for the benefit of members of the editorial and business staffs of technical and trade periodicals, it will also be open to others who are interested in the field. Classes are now being organized in New York. Full information concerning the courses can be obtained by addressing the Secretary of the Course in Industrial Publishing, 185 Madison Ave., New York.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

Gas and Fuel-Oil Heating Discussed by New York Chapter.

Under the general subject of "Domestic Heating, Ventilating and Air Conditioning," which will be continued through several meetings, the New York Chapter opened its season October 17, at the Building Trades Club, with a discussion of "The Use of Gas and Oil for House Heating." Due to the widespread interest in this development which has made such rapid progress of late and to the effective publicity work of the chapter's secretary, J. E. Bolling, the club hall was filled to overflowing when President A. S. Armagnac called the meeting to order, at the conclusion of one of "Forbes' famous dinners."

Before proceeding with the regular program, the chairman presented the new director of the heating engineers' Research Laboratory, Dean F. Paul Anderson. Dean Anderson was warmly greeted by the assemblage which gave him a rising welcome. Dean Anderson responded in a happy vein, quickly removing any impression that his long university experience had clothed him with the proverbial scholastic dignity so often associated with college professors. He told briefly of the progress of the work at the Research Laboratory since his appointment as director last August and assured his hearers that he would appreciate and welcome their suggestions and co-operation in carrying on the work of the laboratory.

Nils T. Sellman, of the American Gas Association, began the technical program with a paper on "Steam and Water Heating by Gas." Mr. Sellman presented much interesting and up-to-date data on the present state of development in this field, and showed how both small and large buildings were being successfully equipped with gas-heating apparatus. He emphasized the fact that the usual types of heating boilers are not adapted to gas heating work, except in special cases, due to the lack of baffling and consequent high flue temperatures. He gave a number of figures showing the economy of gas heating when operated under thermostatic control, which, of course, was a vital factor in gas heating work.

Harry G. Davis, president of the Cornell Utilities Company, took up the subject of oil heating for installations up to 2100 sq. ft. of direct radiation. Mr. Davis, after discussing the general principles, took up in detail the NoKol oil-heating apparatus. He said that while in the past great attention has been paid to the means of atomizing and feeding the oil to the burners, the key to successful oil burning lay in the combustion pot itself.

Mr. Davis stated that while most oil-burning companies had found it necessary to retain control of the sale and installation of their apparatus, his own company had arranged to have the NoKol system handled by the heating trade.

The third speaker was William C. McTarnahan, of the Petroleum Heat & Power Company. Mr. McTarnahan stated that his work had been confined principally to the larger types of installations but that arrangements had been recently completed whereby the Caloroil oil-burning system, heretofore handled by the General Oil Burner Sales Corporation, of New York, would hereafter be handled by the Petroleum Heat & Power Company. Production on a commercial scale, he stated, has already commenced, this burner being especially adapted for househeating work.

Before adjournment, Perry West announced a plan that is being considered by the council of the society to issue what will be known as the "A. S. H. & V. E. Guide Book." It is designed to be an annual publication and will contain the announcements of manufacturers of heating and ventilating apparatus but arranged in a manner similar to the A. S. M. E. Condensed Catalogue and the Chemical Catalogue. It is proposed in this way to raise an amount estimated at several thousand dollars, some of which will be used to defray the expenses of the annual meeting of the society and the remainder to expand the work of the Research Laboratory. Before the meeting closed it was announced that $2500 worth of advertising space had been sold during the evening at a rate of $100.00 per page. In addition to the announcements of manufacturers it is proposed to include in the book a synopsis of the society's history and achievements, the text of its adopted standards, a compend of its most useful data and a list of consulting engineers, architects and contractors, as well as technical journals most closely associated with heating and ventilation. It is hardly possible that the book will be ready for the next annual meeting of the society in January, but it is probable that subsequent issues of the Reference Book will be made coincident with the annual meeting.

The chapter's tentative program for the season is as follows:

November 21. Domestic Heating, Ventilating and Air Conditioning-Solid Fuels: Hard and Soft Coal, Coke, Briquettes. In charge of P. J. Dougherty, of the International Heater Company.

December 19. Domestic Heating, Ventilating and Air Conditioning.—Humidification and Cleansing. In charge of C. W. Baker, consulting engineer, New York.

February 20. Recirculation of Air in Heating, Ventilating and Conditioning: Purification, Deodorization and Ozonation. In charge of Arthur Ritter, American Blower Company.

March 20. Forced Water Heating. In charge of W. L. Durand.

April 17. Drying and Processing of Materials. In charge of Burt S. Harrison, of Drying Systems, Inc., Chicago, Ill.

May 15. The chapter will be the guest of Vice-President W. H. Carrier, at the plant of the Carrier Engineering Corporation, in Newark, N. J.

Illinois Chapter Elects Officers

New officers of the Illinois Chapter, elected at its opening meeting of the season at the Engineers' Club, Chicago, October 10, are as follows:

President, J. A. Cutler; vice-president, Benjamin Nelson, retiring secretary; treasurer, August Kehm; secretary, H. G. Thomas. Board of governors: J. C. Hornung, retiring president, H. R. Linn and C. D. Allan.

The building situation in Chicago and Illinois was the subject of a talk by Henry K. Holsman, past president of the Illinois Chapter of the American Institute of Architects, who took a hopeful view of the outlook. The chapter's membership roll was increased by the election of A. B. Martin of the Kewanee Boiler Company, and F. D. Engles, of the C. A. Dunham Company.

Current Heating and Ventilating Literature.

Under this heading is published each month an index of the important articles on the subject of heating and ventilation that have appeared in the columns of our contemporaries. Copies of any of the journals containing the article mentioned may be obtained from THE HEATING AND VENTILATING MAGAZINE *on receipt of the stated price.*

VENTILATION.

The Ventilation and Humidification of Textile Factories, H. N. Leask. Engineering, vol. 112, no. 2900, July 29, 1921, pp. 202-204, 2 figs. Describes apparatus designed by A. B. Cleworth to meet all requirements of constancy of humidity and ventilation, etc. Presents chart showing average monthly temperatures in weaving shed. Paper read before Rochdale Cotton Spinners' Mutual Improvement Society. 50c.

Death of Prator Dugger.

The many friends of J. P. Dugger, for thirty years secretary of the Kewanee Boiler Co., Kewanee, Ill., will be shocked to learn of his death, October 29, at the Altenburg Hotel, Indianapolis, Ind., from an intestinal hemorrhage. Mr. Dugger had been suffering from a serious illness which necessitated the amputation of his left leg about a year ago. Since that time he had been in poor health, but only recently delighted his friends by appearing at a recent meet of the Western Trade Golf Association where he was re-elected handicapper.

"Prator" Dugger, as he was known to his intimates, had always been identified with the heating trade, being originally connected with the John Davis Company. Both he and his brother, Sam Dugger, who died in 1919, were outstanding figures in Chicago trade circles, their singularly winning personalities making them general favorites in both trade and social circles.

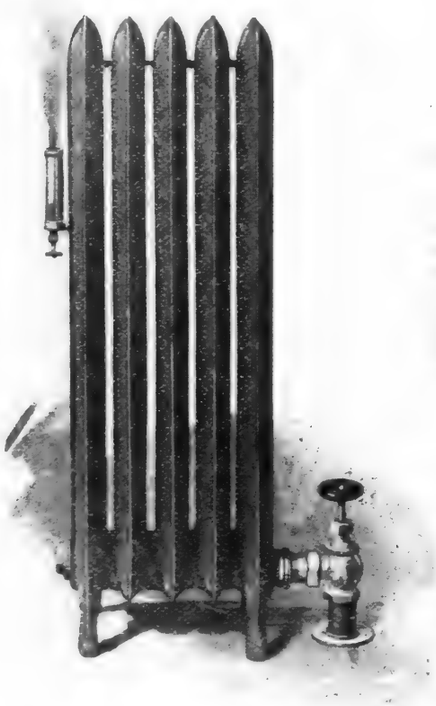
HUMIDIFYING DEVICES FOR THE HOME

No. 16—The Douglass Humidifier.

A novel type of house humidifier which might be described as direct-acting is made by Thos. J. Douglass & Co., Chicago, Ill. The design is that of the Steamo and Vapo air moisteners, formerly manufactured by the Air Moistener Company, whose business was recently taken over by Thos. J. Douglass & Company.

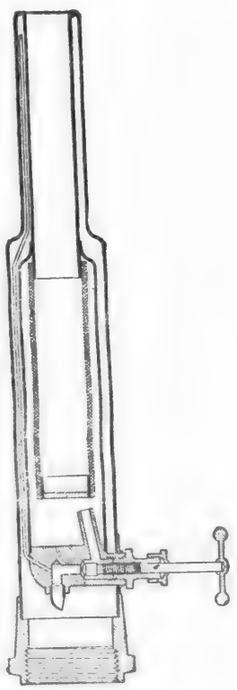
The Douglass humidifier is intended to be attached to a steam pipe, or to a radiator in place of the air valve, and is arranged to discharge steam into the air noiselessly and without spitting water. It has a capacity of about ¾-lb. of moisture per hour per pound of steam pressure. The device, it is stated, can easily be attached to a radiator and will operate indefinitely without attention.

Steam is admitted to the moistener through a regulating valve. This regulating, or control, valve can be adjusted to control the amount of steam discharged. This steam passes into a silencer chamber undergoing an increase in volume and a corresponding decrease in pressure, the temperature being maintained constant by live steam in the jacket.



DOUGLASS RADIATOR HUMIDIFIER.

The silencer consists of a cylinder of porous material, the lower end of which is plugged and the upper end fitted to a vertical metal pipe through which the steam escapes into the atmosphere. From the silencer chamber steam flows through the silencer from outside to inside and then up into the room. The virtue of the silencer is that it lengthens the period of transformation from high to low pressure and keeps the air waves, resulting from the attendant volume increase, below the limit of audibility. The same arrangement which produces this effect also serves to prevent an excessive escape of steam into the room. The steam jacket serves to keep the temperature up while the pressure is decreasing, thus insuring the delivery of perfectly dry steam for humidifying purposes.

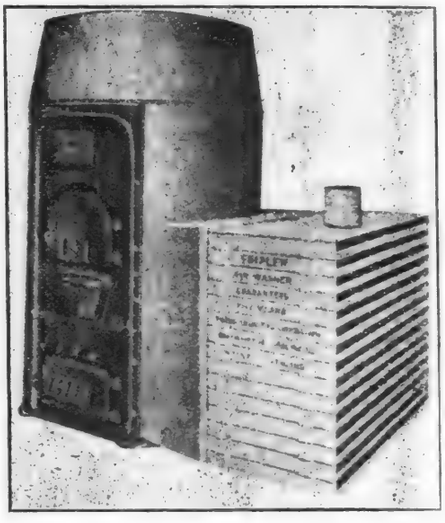


DOUGLASS HUMIDIFIER AS DESIGNED TO BE ATTACHED TO STEAM PIPE.

No. 17—The Triplex Air Washer.

One of the most recent devices in the way of house humidifiers has been developed by the Frank Foundries Corporation, of Davenport, Ia., and is known as the Triplex air washer. This appliance, as will be seen from the accompanying illustration, is designed to be attached to the casing of a recirculating warm-air furnace. In this instance, it is attached to a furnace of the pipeless type and is located in the path of the recirculated air. The manufacturers state, however, that it can be adapted to any type of air heater. It is also furnished in designs suitable for installation on radiators.

The Triplex air washer is made of a number of No. 12 gauge zinc pans, 40 in. long, 20 in. wide and 1 in. deep. It has an overflow ⅝-in. high near the center of the pans. Provision is made for a hot water pipe connection to the air washer which supplies the necessary water. The water should be allowed to flow until the pans are filled with steaming hot water. This is sufficient to last for one day. To replenish them the water is turned on, say, each morning and allowed to run ½ minute for each pan.



TRIPLEX WASHER.

When properly installed all the air in the building passes over the water from 4 to 10 times an hour, depending on the amount of fire in the furnace. In this way the dust, lint, germs, etc., are arrested in the water. At the same time the water is being evaporated, the capacity of the appliance being given as several gallons per day.

To determine the size of air washer necessary for a furnace it is necessary to figure the combined area of all the warm-air pipes. To this total is added 10% and the result divided by 40, this being the number of inches of air space between each pan.

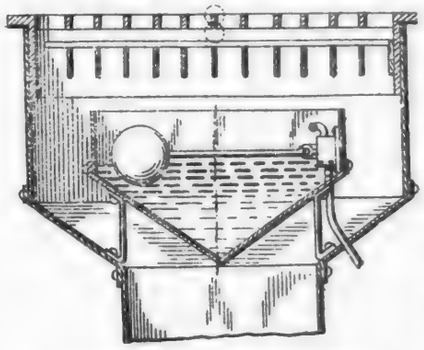
The ease with which the Triplex air washer may be removed and cleaned is mentioned as one of its principal advantages. To cleanse the pans themselves, they may be flushed with water, the overflow passing into the sewer. If there is no sewer, it is recommended that about once each season, the air washer should be taken down and the pans cleaned with a broom or brush.

No. 18—Griffin Warm-Air Register Humidifier.

A device for both moistening the air and catching dirt and dust which would otherwise fall into the air duct, has been designed by Dr. George G. Lewis, of Syracuse, N. Y., and has been named the Griffin humidifier. It is intended to be placed directly below the floor level in a warm-air register. A float valve in the water tank serves to maintain a constant water level and this eliminates the necessity of continually filling the tank as the

water is evaporated. The tank is fed from the domestic water supply line.

By placing the evaporating tank in the path of the air flow, a maximum of evaporation is assured. By locating the tank itself under the register face, it is removed from the danger of unauthorized meddling.



GRIFFIN WARM-AIR REGISTER HUMIDIFIER.

Kata-Thermometers Now Made in America.

Interest in the Kata-thermometer on the part of American heating engineers will be increased by the knowledge that this unique instrument, the invention of Professor Leonard Hill, F. R. S., of London, and described as a comfort meter and evaporimeter for measuring the efficiency of ventilation and cooling and drying processes, is now being handled by H. N. Elmer, 1641 Monadnock Building, Chicago, Ill., general agent for North America for Siebe, Gorman & Co., Ltd. In a recent circular describing this instrument directions are given in detail for its use for measuring the cooling power (or, in a very warm atmosphere, of the warming power) of the atmosphere on a surface at approximately body temperature.

For instance, to investigate the condition of the atmosphere the procedure is as follows:

1. Take the wet and dry-bulb thermometer readings.

2. Take the wet and dry-bulb kata readings.

3. Take the surface temperature of the cheek indicating the cooling effect of the air on the skin.

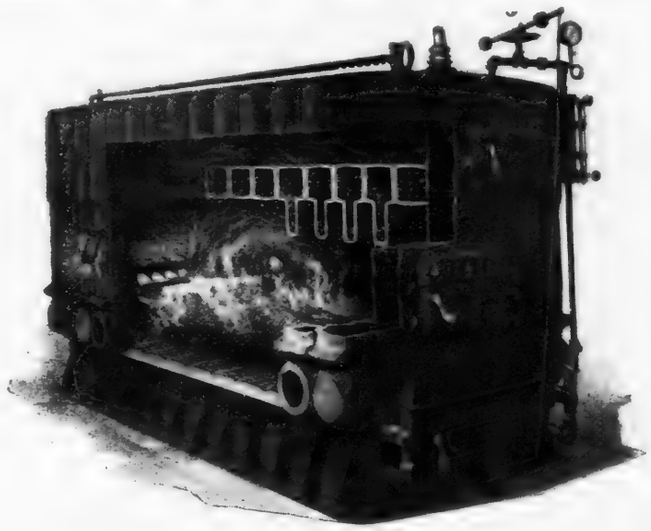
4. Take the surface temperature of a piece of black fur. The difference between this and the air temperature indicates the effect of radiant energy on the skin and clothes. Indoor readings should be taken at the head level, either screened from or exposed to any source of radiant heat, depending on the problem being studied; also at the ground lever to show any difference of conditions between the head and feet. In this way the cooling power in drafts and stagnant places may be compared. In rooms where sedentary workers are present it is stated that the dry kata cooling power should not be below 6, and the wet kata cooling power not below 18. For physical work, the cooling powers should, of course, be greater.

Typical calculations are included in the circular covering a variety of conditions, such as calculating the dry kata cooling power in still air, knowing the temperature, and calculating the wind velocity from the dry kata reading, also calculating the wet kata cooling power from temperature, vapor tension and wind velocity data.

PRESENT STATE OF THE ART IN SMOKELESS BOILER CONSTRUCTION

No. 29—Richardson Smokeless Boiler.

The Richardson smokeless boiler, made by the Richardson & Boynton Co., New York, is of the cast-iron, sectional type with the base also made in sections to facilitate addition of heating sections in case the boiler capacity has to be increased. This is an up-draft boiler with a single horizontal grate of large area. The grate bars, rocking type, are of sturdy ribbed construction and are arranged to shake in two sections.



CONSTRUCTION OF RICHARDSON SMOKELESS BOILER.

In this boiler the bridge-wall section, located well back, is designed to admit the auxiliary air supply necessary for smokeless operation. This air enters from each side of the section through what are called air injectors, being openings provided with dampers which can be adjusted to vary the area of the openings. The auxiliary air supply is heated in passing the fire-brick facing and is then fed into the stream of gas just as it is passing from the fuel chamber to the combustion chamber.

A three-way fire travel is provided in this boiler, with the flue connection at the rear. This gives a considerable heating surface which is still further increased by the special shape given to the sections above the fuel chamber.

Statistics on Construction.

Bulletin No. 2 of the U. S. Department of Commerce, being a national survey of current business as of September 1, 1921, contains a tabulation of building contracts awarded, which seems to indicate a favorable tendency along construction lines. The classification includes business, industrial, residential, and educational buildings, hospitals and institutions, public buildings, public works and public utility construction, social and recreational buildings, and religious and memorial buildings. A section of the table, giving the grand total figures by months, is reproduced in Table 1 below. The figures are compiled from data collected by the F. W. Dodge Company.

TABLE 1—BUILDING CONTRACTS AWARDED.

Year and Month.	Grand Total.		
	No. of projects	Sq. ft.	Value. (Multiply by 1000)
1913 monthly average ..			$71,475
1914 monthly average ..			60,020
1915 monthly average ..			78,341
1916 monthly average ..			113,082
1917 monthly average ..			134,086
1918 monthly average ..			140,770
1919 monthly average ..	6,862	46,333	214,990
1920 monthly average ..	4.821	33,383	211,102
1920.			
January	3,906	41,952	226,116
February	3,504	34,914	200,757
March	5,367	54,495	302,133
April	6,742	50,962	304,974
May	6,193	41,306	246,935
June	5,584	36,979	260,111
July	5,131	27,745	204,498
August	5,129	28,220	202,652
September	4,758	25,832	178,179
October	4,449	25,469	177,758
November	3,839	18,802	128,966
December	3,249	13,926	100,145
1921.			
January	2,834	15,359	111,608
February	3,361	16,772	100,677

March	5,981	26,703	164,092
April	7,176	34,471	220,886
May	7,530	35,731	242,094
June	7,919	35,738	227,711
July	6,440	31,717	212,491
August	7,684	35,246	220,721

This Survey of Current Business is a monthly supplement to the Commerce Reports. Its subscription price is $1 a year alone, and $4 a year with the Commerce Reports. Remittances should be made to the Superintendent of Documents, Washington, D. C.

THE USE OF NOZZLES IN THE TESTING OF RECIPROCATING MACHINES AND OF OTHER MACHINES OF THE DISPLACEMENT TYPE

Nozzles are one of the most valuable pieces of equipment in measuring the flow of fluids. Their application in the measuring of steady flow is well known and needs no further mention here.

When nozzles and some sort of measuring device for differential pressure are used for pulsating flow, errors result, unless the flow curve is known as a function of time. This fact is easily illustrated by reference to Fig. 1 which represents flow of fluid plotted against time. In this special case it is assumed that the velocity of flow fluctuates periodically and abruptly between the valves of 10 ft. per second and zero. Evidently, the average velocity must equal 5 ft. per second.

If, however, the velocity is measured by an instrument such as a nozzle, or a Venturi meter, or a Pitot tube, in conjunction with a differential pressure gauge, the instrument will not measure the average velocity directly but its readings will fluctuate between 10^2 and 0^2; i. e., the readings will fluctuate between 100 and 0. If now the gauge be throttled down so that it can be read, then it will show the average between 100 and 0 or 50, but the square root of 50 does not equal 5, but equals a little more than 7, and the conclusion is that the instrument will show 7 ft. per second, instead of the actual average velocity of 5 ft. per second.

This in itself would do no harm if we knew beforehand how much the excess reading is, but, as before stated, to that end we must know the flow curve.

Let the flow curve be as in Fig. 2, which again represents velocity of flow plotted against time and let the velocity fluctuate now only between 6 ft. per second and 4 ft. per second. Then the readings of the instrument will fluctuate between 36 and 16, these being the squares of 6 and 4. The average between 36 and 16 equals 26 and the square root of 26 is but little more than 5, from which it can readily be seen that the error becomes quite small if the violence of the fluctuations of flow can be decreased or damped. Several means can be employed for accomplishing this result.

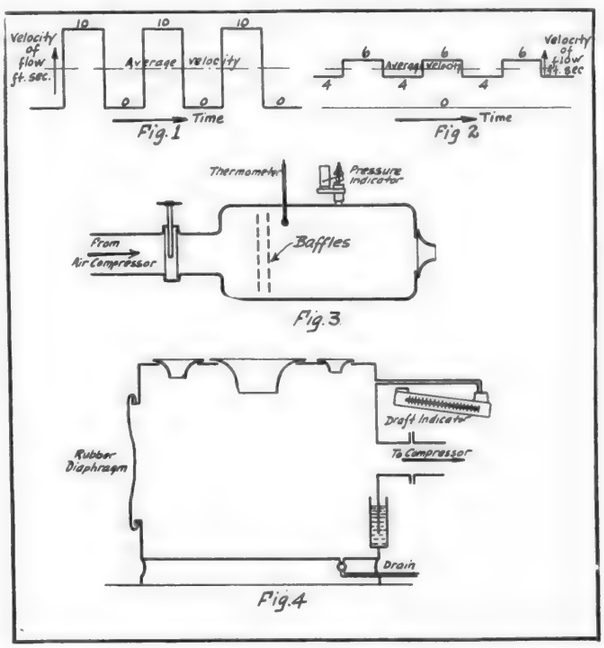
In the testing or in the regular supervision of the air delivery of reciprocating compressors it is quite possible to install a large tank between the compressor; i. e., between the compressor and the delivery line. This tank may well act as an after cooler for removing the moisture from the air. If this tank be about three or four times the volume of the high pressure cylinder, the flow fluctuations are greatly reduced, and if, in addition, a throttling flange be applied at the end of the tank; i. e., at the place where the tank joins the delivery pipe, then the flow in the delivery pipe will be made quite even and a nozzle or a similar instrument can be used with great accuracy. The larger the tank, the more uniform is the flow, and the smaller the throttling flange, the more uniform is the flow. The flange need not be so small as to produce any noticeable pressure drop.

The same method can also be used in the application of steam meters to measure the flow of steam for reciprocating engines. Every engine should be equipped with a large receiver separator and can, in addition be equipped with a throttle flange at the place where the steam main joins the receiver separator. The flow is made even enough to apply a steam meter and to accept its readings without any correction.

There is a rumor afloat that the flow in lines carrying variable velocity fluids can be measured even for a distance by placing a fan in the line at either side of the nozzle or of the measuring instrument, the theory being that the fans have inertia and resist pulsating flow, thereby reducing the violence of the pulsations.

RULES FOR APPLICATION OF NOZZLES.

In the testing of air compressors and blowing engines, or of Roots blowers, the following methods for the application of nozzles have been found quite successful. As shown in Fig. 3, a valve may be placed in the discharge line from the air compressor or blowing engine, and a tank with the nozzle may be placed at the end of the line. The valve serves the purpose of varying the pressure against which the compressor discharges, and at the same time reduces the fluctuations of flow in the tank. The fluctuations proper can be measured by an indicator which is mounted on the tank and the drum of the gauge is pulled as evenly as possible by hand. The indicator gives at once the average pressure in the tank and the fluctuations of pressure. The diameter of the nozzle and the pressure of the air in the tank, together with its temperature, immediately give the quantity of air flowing. Any corrections for variations in velocity can be made as indicated in Figs. 1 and 2. The baffles are necessary for eliminating the effects of velocity of approach upon the nozzle and should consist of perforated plates or strong wire mesh.



USE OF NOZZLES IN TESTING WORK.

For the ordinary run of shop compressors, it is usually preferable to test the compressor while it is in operation. This can be done by using nozzles on the inlet side provided, of course, that the piston rod packings are tight. In this case it is quite easy to secure uniform flow by attaching to the compressor

inlet a sheet iron box which carries the nozzle or nozzles, and which, in addition, is equipped with a rubber diaphragm, as shown in Fig. 4. The volume of the box acts as an equalizer and the rubber diaphragm which flops in and out helps materially to maintain an almost constant flow through the nozzles. A box of this sort is a very valuable adjunct to mechanical laboratories and especially in shops where air compressors are built or used, because it allows testing of the actual air compressor delivery with very little trouble. To this end, it is advisable to have several nozzles in the box and to plug up those which are not in use. It is very desirable to have a safety valve on the box to protect the rubber diaphragm from injury in case someone should close more nozzles than is good for the rubber. Such a safety valve is indicated on the right-hand side of the box in the shape of a U-tube full of water. The section of the U-tube must be large enough to prevent the formation of such a vacuum in the box as might break the rubber diaphragm. The pressure drop of the nozzles can be kept quite small, and can be measured by means of an inclined gauge, such as a draft gauge. The pressure drop through the nozzles amounts to much less than the variations in barometric pressure and no fear need exist that the measuring box will in any way interfere with the air delivery of the compressor.

Nozzles have not been used for testing to the extent which they deserve, probably for the reason that it is troublesome and expensive, first to lay out nozzles, and then to machine them. These obstacles, however, it is stated, have been removed by the Bacharach Industrial Instrument Co., of Pittsburgh, which has developed standard nozzles for almost all purposes of testing. It may also be stated that the discharge from positive blowers, such as the Roots or Connersville blowers, is likewise pulsating and needs some means for reducing the fluctuations.

New Apparatus and Appliances

Dial Thermometers of French Design to be Made in America.

Arrangements have been completed by the Sarco Co., Inc., New York, by which it has secured the American rights for manufacture and sale of the Fournier type of thermometer. License has been granted to this concern by the Société Des Appareils Fournier of Paris, covering the use of a number of United States Patents granted to Professor Fournier on this type of instrument.

Fournier thermometers are of the saturated vapor type whose operation is based upon the principle that tension of a saturated vapor is a function of the vapor temperature and is independent of the volume which it occupies. This being so, the pressure within the apparatus is constant for any given temperature and changes only with change of temperature. Thermometers of this type can be made for measuring temperatures from —90° F. to 1300° F. Of course, no single thermometer will cover such a range, the usual ranges of a given instrument being —90° to 90°, from zero to 240°, from 150° to 350°, from 300° to 700°, and from 700° to 1300° F. The limits of range are determined by the character of the filling used. For the lowest temperatures an inert gas filling is used while mercury vapor is employed for the highest temperatures.

Fig. 1 shows the Sarco indicating thermometer ready for use, with transmission tube T and bulb B connected to the instrument. The bulb is the portion exposed to the temperature to be measured. In Fig. 2 is shown an internal view of the instrument with case and dial removed, exposing the Bourdon tubes N-N, the pointer P, and the hair-spring H which comprise its operating mechanism. The manner of operation is simple. Exposure of the bulb to a temperature produces upon the contained vapor a corresponding pressure which is carried through the transmission tube to the Bourdon tubes. These are fixed at their lower ends but free at their upper ends. An increase in internal pressure tends to straighten out the tubes

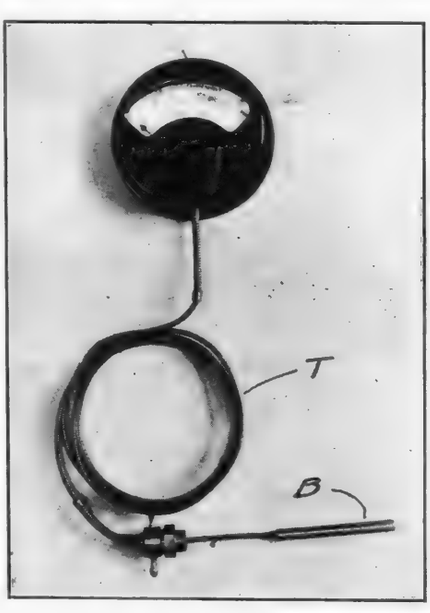


FIG. 1—SARCO INDICATING THERMOMETER.

and this forces their ends apart. This motion is applied, through a compound lever mechanism, to the swinging of the pointer which registers the corresponding temperature on the dial face. The hair-spring attachment serves to take up backlash and helps to make the movement of the pointer dead-beat. The lever mechanism shown, is of a type that produces small deflections at both start and end of its range of motion, so that the dial scale is uneven (see Fig. 1).

By filling the transmission tube with a liquid having low expansion coefficient, it can be furnished in lengths up to 500 ft.

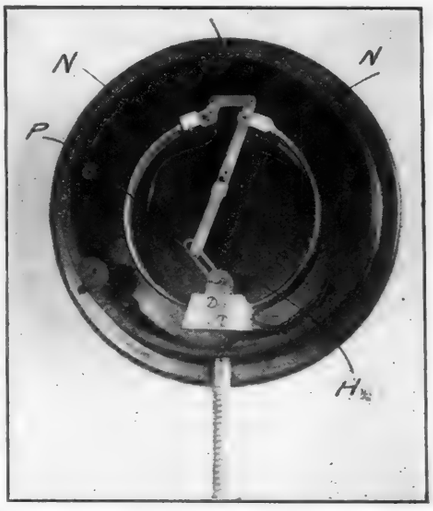


FIG. 2—INTERIOR VIEWS OF SARCO INDICATING THERMOMETER.

and this instrument, so arranged, has the added advantage that the transmission tube can be carried through temperatures much higher or lower than those under measurement, without affecting the accuracy of the measurements.

Hardinge Oil-Burning Machine.

An interesting type of oil-burning machine has recently been placed on the market by Hardinge Bros., Inc., 1770 Berteau Avenue, Chicago, Ill., representing the design of Franklin Hardinge and associates. The fact that this company has long been manufacturing tools for watchmakers, precision lathes and machinery is emphasized as indicated the company's ability to manufacture successful machinery of fine character. One of the particular features mentioned of this apparatus is the arrangement by which, with a machine capable of heating the average ten-room residence, the burner can be turned down so low that its fire will not consume more than ½-gal. of fuel-oil per hour. On the other hand, when a hot fire is needed, it can be had instantly.

In the accompanying illustration (Fig. 3) the arrows indicate the course of the oil from the time it enters the machine until it is burned. The oil is drawn from the supply tank (which is under the floor) up through the strainer and through the pump which is located at point "A." It is then forced into the pressure chamber at point "B" and is kept under pressure by the pump. Oil now passes upward through the revolving needle valve seat which regulates the quantity of oil to be burned and follows the line of the arrows up to the standpipe openings "C." From this point the oil flows downward to the bottom of the revolving cup of the atomizer where centrifugal force throws it through the tube of oil which is held in the diameter "D" by centrifugal force.

Following the line of the arrows, the oil reaches and is constantly emulsified at bottom of the cup by the agitator. While traveling upward through the cup, as indicated by the arrows, the oil to be burned has time to be separated from the dirt, water and other substances and all find their logical positions according to their specific gravities.

The space behind the tube of oil is kept constantly filled with dirt, water and other substances which are constantly extracted from the oil by this treatment. The oil, which is lightest, comes up to the smallest diameter and passes out over the atomizer into the fire box following the line of the arrow. The dirt, water and other substances, all of which are heavier than oil, constantly pass off under the oil and are consumed.

The only place where any dirt can possibly collect it is stated is on the convex curve of the atomizer bell and this is cleaned by drawing the small steel poker over the bell's surface while the machine is in motion. Intervals for cleaning the atomizer bell may vary according to the kind and amount of oil to be burned. For instance, a small-sized burner in a home ordinarily need not be cleaned oftener than once in two weeks; a commercial heating machine might need cleaning once a week. A clean atomizer bell means perfect atomization.

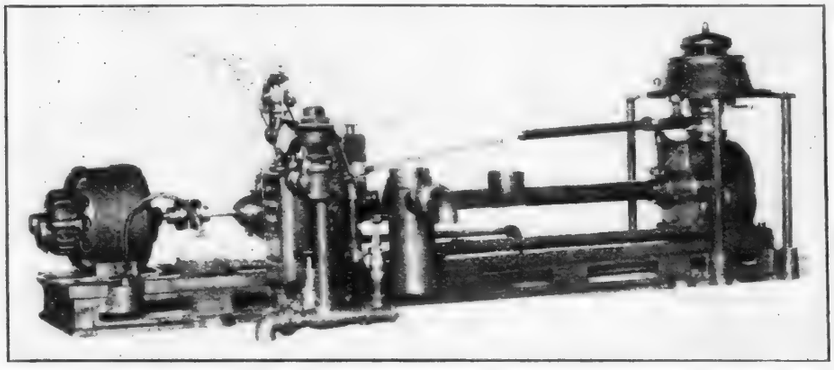


FIG. 1—HARDINGE OIL-BURNING MACHINE, WITHOUT HEARTH PLATES, READY TO INSTALL UNDER BOILER.

As the oil leaves the bell shaped atomizer it is thrown by centrifugal force into the fire box and formed into globules as indicated by dots. The whirling air vanes "E-E" force a volume of air out under and up through the oil as indicated by the lines. This creates the fuel-oil gas.

Seven important features are mentioned as being covered in the patents applied for on this machine. These include (1) the atomizer and agitator which treat the oil before burning, (2) the revolving needle in oil-feed valve which feeds the oil in small, regular quantities, (3) the pressure chamber which eliminates all air and water bubbles, (4) the air regulator which regulates the air mixture, (5) the automatic stop which stops the machine and prevents flooding if the fire accidentally goes out, (6) the convenient cleaning method and (7) the oiling system for the atomizer spindle.

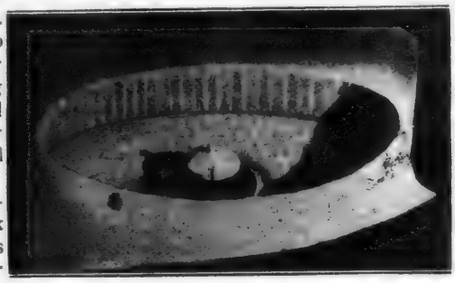


FIG. 2—COMBUSTION CHAMBER, ATOMIZER AND AIR CONTROL RING WHICH REPLACE BOILER GRATES.

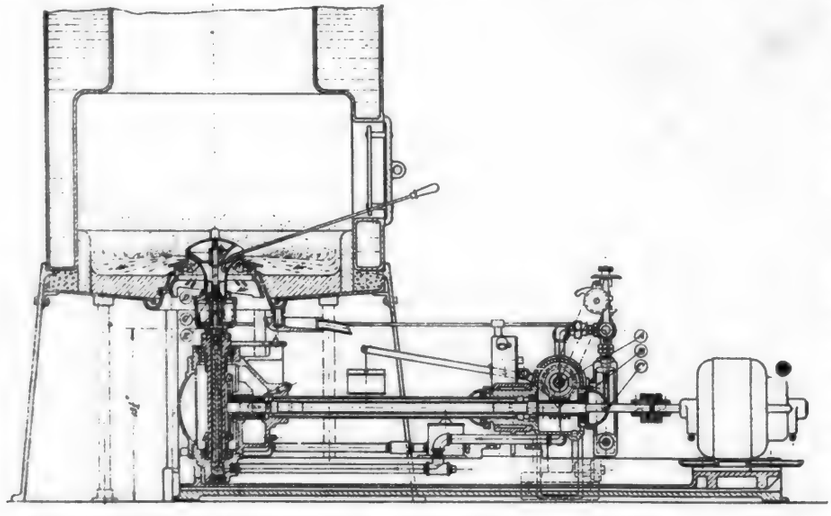


FIG. 3—TYPICAL INSTALLATION OF HARDINGE OIL-BURNING MACHINE.

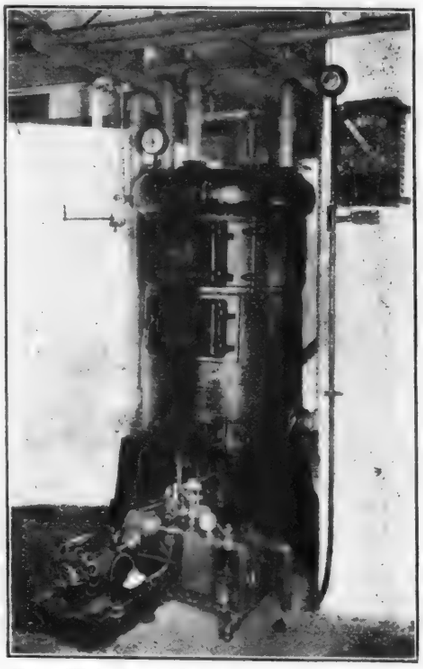


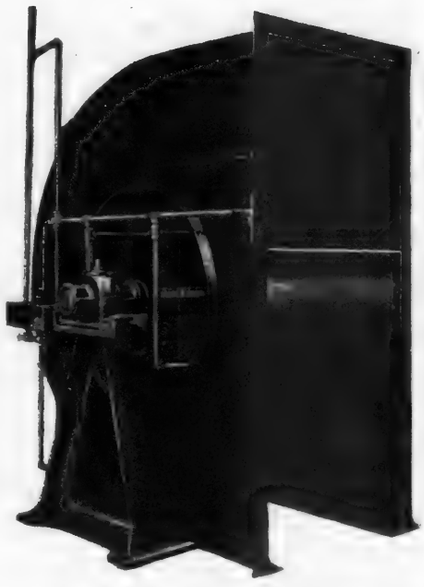
FIG. 4—HARDINGE MACHINE WITH 3-IN. BURNER UNDER WATER HEATING BOILER.

Combination of Fan and Air Washer in One Unit.

An interesting piece of equipment which has progressed beyond the experimental stage to the point of commercial production, is the "A B C" air washing and cooling fan, manufactured by the American Blower Company, Detroit, Mich. In the design of this unit the object was to combine in one piece of equipment the functions of both air washer and fan, thus securing better air-conditioning possibilities for the installation where space is too limited to permit separate apparatus for each of these functions.

The feature of this design is its use of the peripheral blades of the fan as eliminator baffles for the air washer. As far as appearances go, the device looks more like a fan than an air washer, but there is, nevertheless, a very thorough washing process.

A perforated cylinder of heavy steel-plate forms the basis of the impeller wheel and is fastened securely to the arms of the hub. A layer of wire screen, arranged in sections inside this cylinder, forms the filter ring. As previously stated, the fan blades serve as eliminators to extract superfluous water from the air as it leaves the fan. In order to perform this function the outer edges of the blades are turned in to form gutters and these gutters have sufficient slope toward the inlet side of the wheel to drain by centrifugal action into a V-



"A B C" AIR WASHING AND COOLING FAN.

shaped collector ring which surrounds the inlet opening.

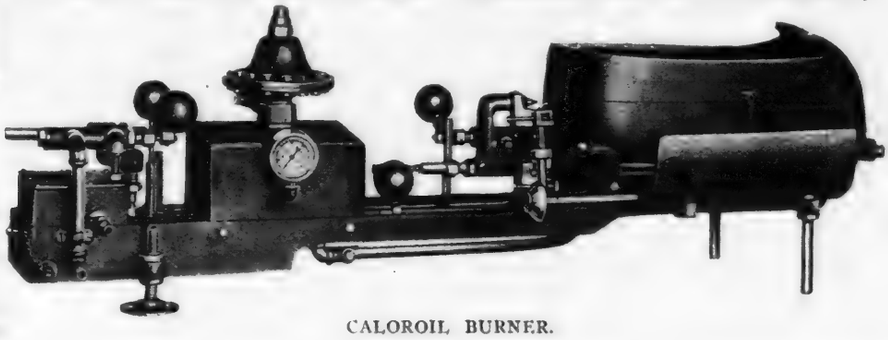
Spraying is effected by stationary spray heads extending into the mist chamber, or center part of the wheel, at the inlet side. Water discharged from the spray heads is still further broken up in passing through the wire screen and perforated cylinder and the air forced through this fine mist is cleansed of solid impurities and gaseous impurities which are soluble in water. The superfluous water which drains from the eliminator blades into

DESIGN OF WHEEL OF "A B C" AIR WASHING AND COOLING FAN.

the V-shaped collector ring, is drawn or forced through a stationary nozzle into the piping system which feeds the spray heads, so that the unit acts as a pump also, maintaining a continuous flow of water in this circuit during operation. By supplying to the system continuously a little more water than the spray heads can discharge, there is provided an excess which is sufficient to make up for the water absorbed by the air for humidification and also to permit an overflow from the collector ring for the purpose of removing impurities washed from the air. This auxiliary water supply is regulated by a float valve and can be adjusted to meet the needs of the individual installation.

The Caloroil Burner.

The announcement that the Petroleum Heat & Power Company, of New York, has arranged to market the Caloroil burner, which has been developed by the General Oil Burner Sales Corporation, of New York, lends special interest to a description of this appliance which is intended for house-heating service. It is designed to burn liquid fuel-oil or kerosene and, it is stated, can be used on any type of boiler or furnace.



CALOROIL BURNER.

A distinguishing feature of this burner, which is of the low-pressure type, is that it requires neither motor nor pump. It consists of a small low-pressure steam generator mounted on a base plate and located in the fire-box. The auxiliary equipment consists of an automatic oil-feed tank, located outside the furnace, a water regulator, a control valve, steam and oil nozzles and combustion chambers.

The generator is connected through the water regulator with the city or other water supply and through a pipe line to the steam nozzles. As the water flows to the generator it is immediately converted into superheated steam which, on passing through the steam nozzles, combines with the necessary amount of oil and air for combustion. Atomization of the oil is effected by the superheated steam and it is immediately released into the combustion chamber where it is consumed.

An essential element in this arrangement is the combination of the atomized oil steam and air at a high temperature and low pressure into a mixture that will produce a flame of intense heat, and one without smoke or odor, and without carbonization. This, it is claimed, has been accomplished in the design of the Caloroil burner. The steam required for atomization ranges from 6 to 14 lbs., depending upon the gravity or the grade of the fuel-oil used.

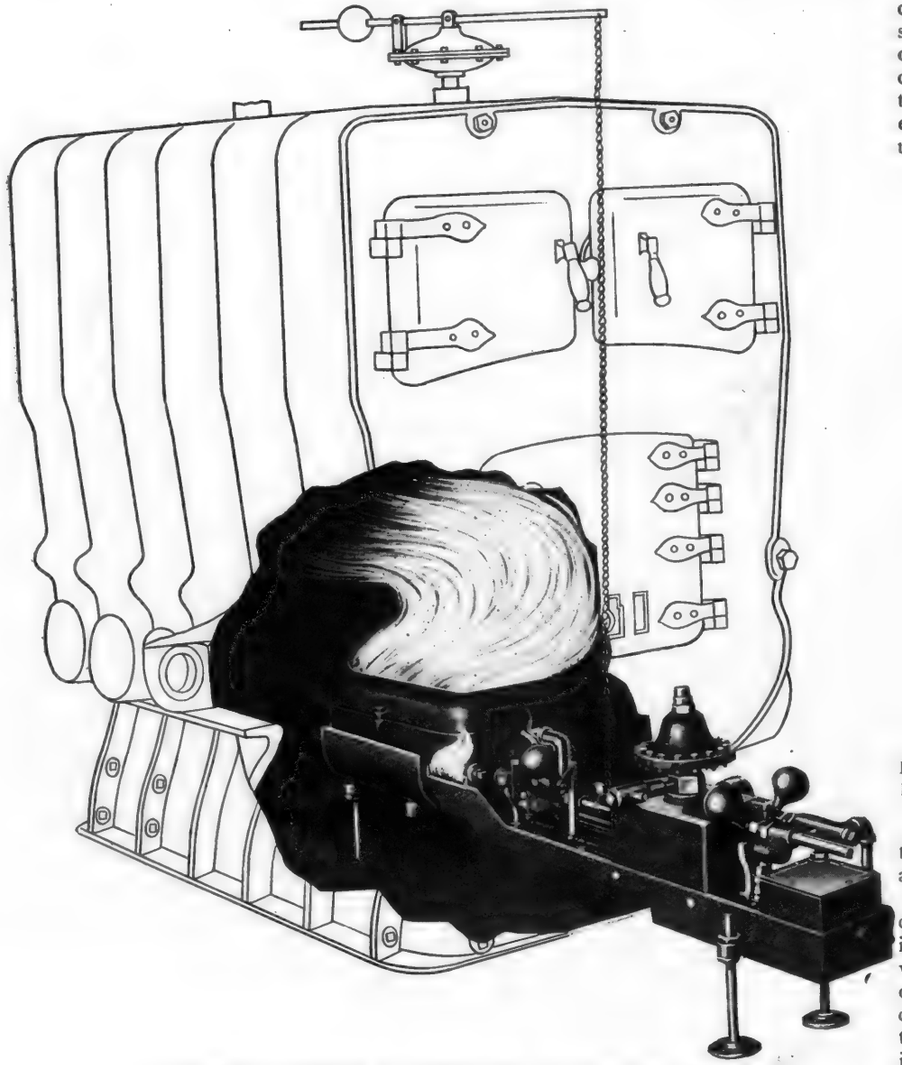
As a safeguard against flooding, smoke and fire, both oil and water shut-off valves are automatically controlled. The oil level is below the atomizer tips and is lifted through the oil pipes and nozzles by superheated steam. The flow of oil ceases when the operation of the burner stops.

Regarding the efficiency of the burner it is figured that less than 2% of the heat is used in making the steam required to atomize the oil. The fact that it is free from moving parts is also mentioned as a factor in its efficient and continuous operation.

Regulation of the consumption of oil is effected either by a thermostat, controlled from the room above, or by a damper regulator.

Double Service Automatic Valve.

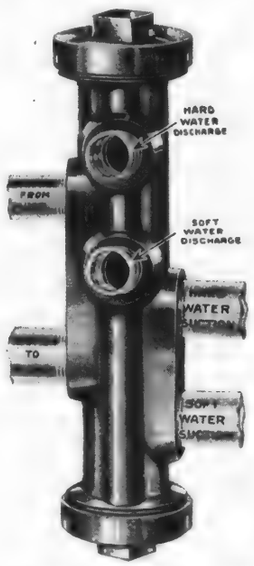
To make one pump do what two pumps did before, is the accomplishment claimed for the Dual automatic valve, manufactured by the Dual Automatic Valve Co., Rock Island, Ill. The particular services mentioned in literature of the company



CALOROIL BURNER AS INSTALLED IN HEATING BOILER.

are the supplying of either hard or soft water from a single pump, without manipulation of valves other than the discharge faucets. A glance at the sectional view of the valve shows how this automatic feature is obtained. Assuming the pump in operation and the soft water discharge faucet closed, then the pressure will rise in the soft water pipe and will raise the piston in the valve to the position shown at "A," when the pump will be operating to supply hard water. If the hard water faucet is closed, the pressure in the hard water pipe will rise similarly and so force the piston down again to the position shown at "B," when the pump will be again operating to supply soft water.

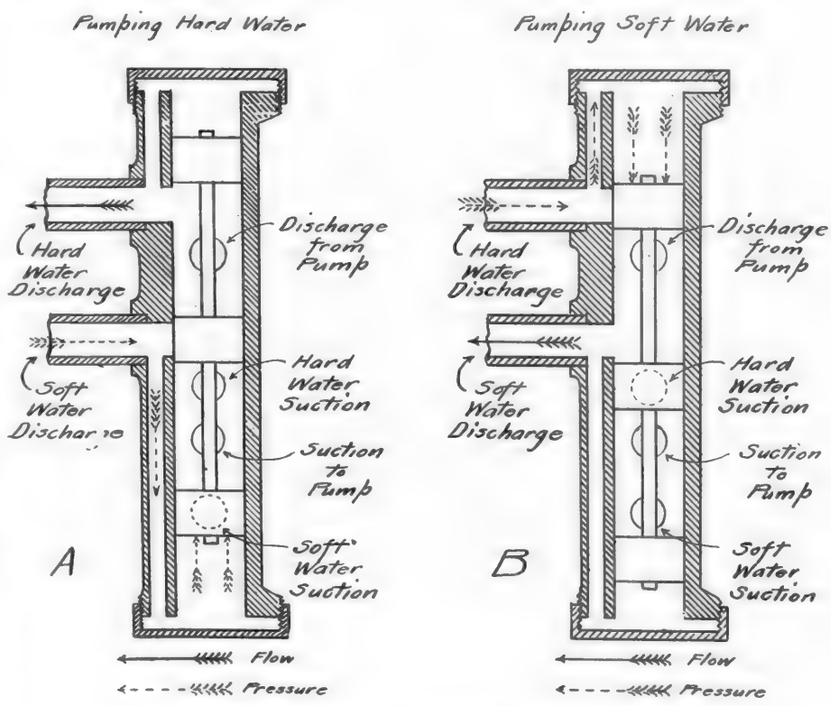
Obviously this valve will not serve to produce simultaneous supplies of both hard and soft water from the same pump. If both hard and soft water faucets are opened there will be obtained at each a mixture of hard and soft water in a stream of about half normal volume. In any case there is bound to be a slight mixture of the two kinds of water at the instant of change from hard to soft or vice versa, but this would make no difference as far as hard and soft, or hot and cold water were concerned. However, the attempt to use such a valve for alternate supply of kerosene and gasoline, for instance, would certainly prove dangerous, because mixtures of these two substances possess the explosive qualities of the gasoline. If used for a combined service of this kind,



DUAL AUTOMATIC VALVE FOR SUPPLYING HARD OR SOFT WATER FROM A SINGLE PUMP.

the greatest care would be necessary to avoid danger of explosion.

By making all parts of this valve of cast-bronze the danger of rusting is eliminated, thus adding to the life of the valve. The simplicity of design and operation, with but three pieces in the case and a single moving part, also tend toward reliability and durability. For installations where both services are



OPERATION OF DUAL AUTOMATIC VALVE.

never required simultaneously, the economy of using such a valve, in place of a second pump, is obvious.

New Publications.

THE INDUSTRIAL DIGEST, described as "a semi-monthly digest of the informative articles in six hundred leading industrial magazines covering thirty industries," is the title of a new perodical, the initial issue being dated October 1, 1921. It is published by the Periodical Digest Corporation, 25 West 45th Street, New York. If the first number is to be taken as any criterion of the new journal's usefulness, it is safe to say that it is going to fill an important niche in the industrial field. Numerous attempts have been made in the past to supply the various trades with industrial digests, but nothing approaching the present plan has been attempted in this country. In each industry is given a section by itself, the more interesting abstracts being accompanied by illustrations which help greatly to relieve a certain dryness which always accompanies a compilation of abstracts on any subject. Among the sections of special interest to heating and ventilating engineers are those on Building Construction, Fuel-Power, and Machinery. The magazine contains 82 pages and in its typographical appearance sets a high standard.

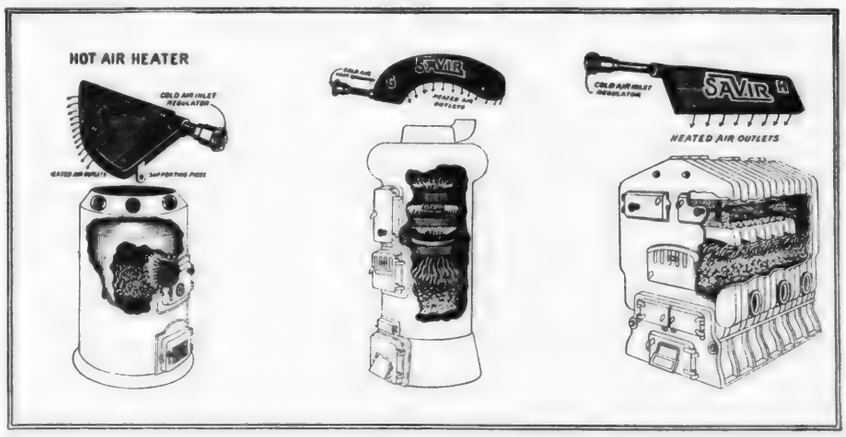
Trade Literature.

THE WEATHER VEIN for October, 1921, the periodical of the Carrier Engineering Corporation, Newark, N. J., is featured as a macaroni number. Under the title of "Yankee Doodle's Feather," an account is given of the history of macaroni and of the methods that have been developed for the automatic processing in connection with its manufacture. Credit is given to Russell T. Tree, now in charge of the corporation's New York office, for the research work in this connection which finally led up to the design of the apparatus now being used for fanning, sweating and drying macaroni and other paste foods. Illustrations are included of a typical ejector dryer apparatus and of actual installations, followed by a technical description of the Carrier ejector system for processing paste goods.

SAVIR COAL SAVING DEVICES, made by A. S. Johnson Co., Newark, N. J., are featured in newly-issued circular matter and constitute further evidence of the growing interest in devices that admit heated air to the combustion chambers of boilers, warm air furnaces and even stoves. This device, the general construction of which can be seen from the accompanying typical illustration, is intended to supply the necessary additional oxygen required to complete combustion and thus reduce the amount of wasted gases. It is also pointed out that with this device the fire is more easily controlled and requires less attention, with the consequent saving of labor in the handling of coal and ashes.

BAYLEY CHINOOK HEATERS, of the indirect type, are brought to the attention of the trade in a recent catalog of the Bayley Manufacturing Co., Milwaukee, Wis. First, this catalog outlines the functions and efficiency essentials of an indirect heater. All of these the Chinook is said to possess, and the pamphlet presents text and illustrations to prove this claim. The second section of the catalog contains tables and diagrams and methods of calculating Chinook heater requirements for various kinds and conditions of service. Printed on heavy coated stock, with numerous illustrations and diagrams, and cover in colors, this book is a notable addition to current engineering literature. Size 7½ x 10½. Pp. 80.

TRANE HEATING SYSTEMS, SPECIALTIES AND PUMPS are described briefly, with illustrations, in a mailing folder received from the Trane Company, La Crosse, Wis. In this folder there are six folds and each one unfolds something good about the Trane line. Among the products described are the Trane graduated valve, Thermetal trap, quick vent valve, float vent trap, direct return trap, damper regulator, vapor vacuum gauge, condensation pump, automatic float switch, and air line vacuum pump. The text is brief and the pictures snappy. Sizes 3½ x 6¼. Pp. 12.



SAVIR COAL-SAVING DEVICE AS DESIGNED FOR DIFFERENT TYPES OF HEATERS.

Eliminating Waste in Estimating.

Through joint action of the American Institute of Architects, the American Engineering Council of the Federated American Engineering Societies, and the Associated General Contractors of America there has been produced a set of recommendations, approved and adopted by these bodies, covering the allied subjects of quantity surveying and payment for estimating. Prefacing the recommendations in a pamphlet recently issued on this subject, are a condensed statement of their general purpose and special notes addressed respectively to owners and investors, to architects and engineers, and to contractors, explaining briefly the advantages of the system to each of these particular groups. The recommendations read as follows:

QUANTITY SURVEYING.

Architects, engineers, and contractors should jointly use their efforts to have established facilities for making quantity surveys.

PAYMENT FOR QUANTITY SURVEYING.

The owner should pay for the quantity survey from ¼% to 1% of the cost of the project for commercial and public work and not more than twice as much for residence work, whether the project is constructed or not.

COST OF THE PROJECT.

The cost of the project may be defined as the accepted bid, or in cases where no bid is accepted, the bid of the lowest responsible bidder as determined by the architect or engineer. However, in cases where alternate bids are required, the additional payments for the quantity survey shall be based upon the additional quantities surveyed, as approved by the architect or engineer.

ALTERED PLANS.

Altered plans which involve a change in plans after the quantity survey has been made justify an addition to the original fee for quantity surveying.

BASIS OF CONTRACT.

Owners should have the option of

a—Making the quantity survey a part of the contract, or

b—Permitting the successful bidder at his own expense, an opportunity to verify the accuracy and completeness of the quantity survey before the contract is signed. If he proves errors to exist in the quantity survey, the bidder shall be permitted to adjust his bid accordingly.

UNIT QUANTITIES AND STANDARDS.

The schedule of unit quantities should conform to local customs or methods of measurement and should be so stated on the quantity survey. The eventual adoption of national standards is recommended.

GUARANTEE.

The guaranteeing of quantities by a quantity surveyor is not recommended, for it might influence the surveyor to protect himself by increasing the quantities. The extra cost of a guarantee would not be warranted.

EXISTING METHODS.

The cost to owners of preparing bids by existing methods, which make necessary wasteful duplication in estimating quantities by several bidders, is known to be much greater than the cost of preparing bids based on a quantity survey furnished by the owner, and therefore such existing methods are condemned and should be discontinued.

Substantial Performance of Heating and Ventilating Contract Warranting Recovery.

In an action for a balance on a heating, ventilating and plumbing contract, Thomas Haverty Co. v. Jones, California Supreme Court, 197 Pac. 105, it appeared that the total cost of the building was about $186,000 and the contract price for installing the plant was $27,332.66. It was held that the sum of $99.21, deducted as the cost of remedying curable defects, was not a matter which would prevent the contractor recovering the balance due as on a contract where the performance was substantial. As to the sum of $2,180.88, which was allowed as damages on account of defects which could not be removed or remedied, where it appeared that the trial court gave the defendant the benefit of every doubt on the subject, and found that the material and construction substituted for that specified in many cases was equally as efficient and durable as that specified, that in many cases better and costlier material was substituted, and that this additional cost was greater than the reduction in cost by the substitutions of less expensive material, and that it was difficult, and in some cases impossible, to obtain materials of the exact character prescribed in the specifications, and that the usefulness of the systems had not been virtually affected thereby, or their efficiency impaired, it was held that the case came within the rule under which a contractor may recover in a suit for the contract price upon showing substantial, though not in all respects complete performance.

A contract to install a heating and ventilating plant in a building to the satisfaction of the owner was held sufficiently complied with by such performance as should be satisfactory to a reasonable person. This rule, the court said, does not apply where the performance involves matters dependent on fancy, taste, sensibility, or judgment of the other party, but it does apply where the question is merely one of operative fitness or mechanical utility, and especially to contracts for the erection of buildings.

The contract provided that the contractor should keep careful and complete records of his installation of the system, and show by drawings "every important detail of the system," and that this record should be delivered to the owner before final acceptance. It was claimed that this condition was not complied with. Drawings were furnished to the owner in attempted compliance with this provision, but though they were, in certain unimportant particulars, inaccurate, no damage was sustained by reason thereof. The owner had never expressed any dissatisfaction therewith, or demanded any different or additional report of statement. It was held that strict performance of this provision was waived.

Judgment for the plaintiff was affirmed.

Annual Meeting of Heating Engineers' Society to Be Held in New York.

Announcement has been made that the next annual meeting of the American Society of Heating and Ventilating Engineers will be held in New York, January 24-26, 1922. The idea of holding this meeting in Washington, which was generally favored by the membership, had to be abandoned on account of the Limitation of Armaments Conference which, it was expected would be going on at that time.

Deaths.

William K. Downey, president of the Downey Heating & Supply Co., Milwaukee, Wis., died at his home in Milwaukee, October 1.

TO OUR READERS.

So many responses were received to the invitation, published in THE HEATING AND VENTILATING MAGAZINE for September, for suggestions on the kinds of articles and topics which our readers would like to see published, that we believe it will be a permanent benefit to both reader and publisher if the invitation can be continued indefinitely.

For this reason we are repeating the invitation and are attaching the following form as a matter of convenience.

Editorial Department,
Heating and Ventilating Magainze,
1123 Broadway, New York.

I should like to have you publish

an article on.....

.....

.....

I should like information on.....

.....

.....

Name .....

Address .....

(In case your questions include problems in design, be sure to send sketches or blue prints of the layout.)

Central Station Heating Company Reduces Its Rates.

Youngstown, O.—Reductions in rates for all users of central station heating service have been announced by the Mahoning County Light Company. The new rates have been filed with the Ohio Public Utilities Commission and became effective at once under the permission of the commission to file on less than statutory notice inasmuch as all the changes in rates are reductions. The reductions are 10 cents per 1000 lbs. on the first 100,000 lbs. used per month and 15 cents per 1000 lbs. on all above 100,000 lbs. These reductions amount to 8% and upward, in accordance with the amount of steam used.

The new rates are as follows: First 5,000 lbs. each month, $1.20 per 1000 lbs.; next 50,000 lbs. each month, $1.05; next 100,000 lbs., 95 cents; next 100,000 lbs., 90 cents; next 100,000 lbs., 85 cents; next 100,000 lbs., 80 cents; next 500,000 lbs., 75 cents; all over 1,000,000 lbs., each month, 70 cents per 1000 lbs.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912, OF THE HEATING AND VENTILATING MAGAZINE, published monthly at Cooperstown, N. Y., for October 1, 1921.

State of New York, County of New York, ss.

Before me, a notary public in and for the State aforesaid, personally appeared A. S. Armagnac, who, having been duly sworn, according to law, deposes and says that he is the Editor of THE HEATING AND VENTILATING MAGAZINE, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in Section 443 Postal Laws and Regulations printed on the reverse of this form to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:

Publisher, Heating and Ventilating Magazine Co., 1123 Broadway, New York, N. Y.

Editor, A. S. Armagnac, 1123 Broadway, New York, N. Y.

Managing Editor: None.

Business Manager: Gustave Petersen, 1123 Broadway, New York, N. Y.

2. That the owners are: (Give names and addresses of individual owners, or if a Corporation, give its name and the name and address of stockholders owning or holding 1 per cent or more of the total amount of stock.)

Heating and Ventilating Magazine Co., 1123 Broadway, New York, N. Y.

A. S. Armagnac, 1123 Broadway, New York.

Gustave Petersen, 1123 Broadway, New York, N. Y.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are:

None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain, not only the list of stockholders and security holders as they appear upon the books of the company, but also in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stock holders and security holders who do not appear upon the books of the company as trustee, hold stock and securities in a capacity other than that of a bona-fide owner and this affiant has no reason to believe that any other person, association or corporation has any interest direct or indirect in the said stock, bonds or other securities than as so stated by him.

A. S. ARMAGNAC, Editor.

Sworn to and subscribed before me this 4th day of October, 1921.

LOUIS JACOB.

Notary Public, N. Y. County No. 21,
(My commission expires March 30, 1922.)

In many homes, particularly town houses or apartments, the space for the heating boiler is very small and frequently adjoins the entrance hall. The IDEAL Type "A" Heat Machine is admirably designed for plans of this character

Economy of Fuel and Space

"It burned 40% LESS COAL this year."—This statement from a grateful owner exceeds the tabulated results from hundreds of installations of IDEAL Type "A" Heat Machines—which average **A FUEL SAVING OF ONE-THIRD.** Besides this fuel economy, this reduced amount of coal requires one-third less storage space, and caretaking.

The **Large Fuel Chamber** holds enough coal to run without attention from 8 to 24 hours, depending upon weather demands.

The **Revertible Flues** and scientifically proportioned surfaces absorb and utilize the heat, preventing its waste up the chimney.

The **Automatic Regulation** prevents waste of heat by controlling the fire to supply the exact volume of heat needed—avoiding *under*-heating and *over*-heating..

The **Ideal Insulated Jacket,** dust-free and gas-tight, permits converting the basement into livable, recreational quarters.

We offer testimonial letters from many prominent users. Specify and use IDEAL Type "A" HEAT MACHINES for NEW or OLD residences.

Write for catalog containing test charts of FUEL ECONOMY and efficiency.

IDEAL Type "A" Heat Machine

IDEAL products are nationally priced and sold by all heating contractors. No exclusive Agents.

AMERICAN RADIATOR COMPANY

Sales Branches in All Large cities

Makers of the world-famous IDEAL Boilers *and* AMERICAN Radiators

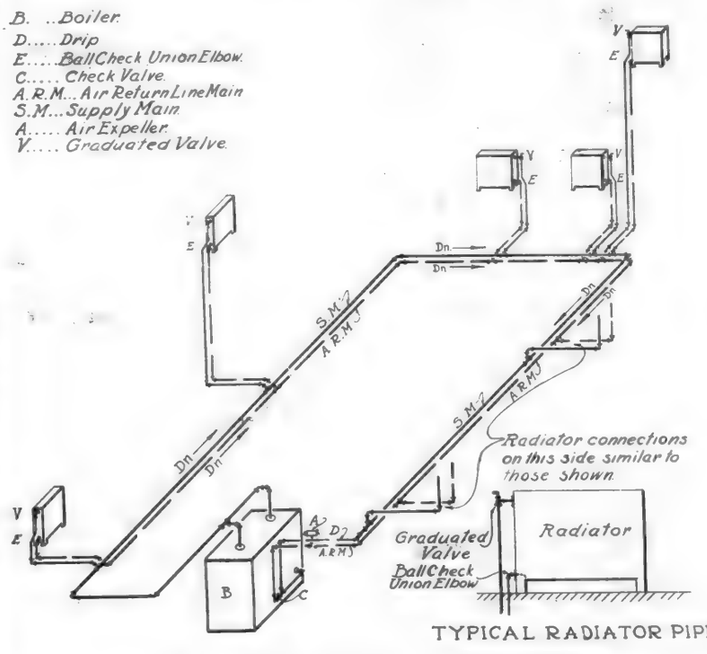
THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. CITY

VAPOR HEATING.

The Richardson System.

A characteristic feature of the Richardson System is the use of the Richardson water-seal ball-check union at the return end of each radiator. This device, shown in Fig. 2, takes the place of a vacuum valve at the radiator and serves also as a return elbow.

A typical piping diagram of the Richardson system is shown in Fig. 1. This illustrates a one-circuit arrangement such as the manufacturers suggest for medium sized installations. It should be noted that a separate air return-line circuit is provided for the supply circuit and this holds true for such cases as require three or four supply



circuits. The manufacturers claim that an air expeller and vacuum valve should be provided for each return line circuit.

The Richardson air expeller and vacuum valve, shown in Fig. 3, is located on the air return-line near the boiler and serves to vent the air from the system, closing when vapor or steam starts to pass through it and remaining closed as long as there is a vacuum in the system. Condensation in the return-line passes through a Richardson horizontal swinging check valve, shown in Fig. 4, into the boiler. This check valve prevents the return of water direct from the boiler into the return line.

At the supply end of each radiator is placed a Richardson packless, graduated supply valve, as shown in Fig. 5, which is furnished in three sizes.

One feature of the Richardson system which is specially emphasized by its manufacturers, the Richardson & Boynton Company, New York, is that it will operate satisfactorily as either a vapor, a vacuum, or a pressure system. For use with this system they recommend water type radiators, and the same amount of radiation as would be required for a gravity steam system.

(Concluded on Data Sheet No. 132-EE)

Copies of this Data Sheet, printed separately, 5 cents each.

THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. CITY

VAPOR HEATING.

The Richardson System.

(Concluded from Data Sheet No. 132-DD)

The following tables give the pipe sizes recommended by the manufacturers for use with this system. These tables are based on the assumption that no unusual conditions prevail and that the radiation is sufficient to maintain a temperature of 70° F. Emphasis is laid on the need for maintaining proper grades. All lateral pipes and branches should have a grade of at least 1 in. in 2 ft. and both the supply and the return lines mains should have a grade of 1 in. in 20 ft.

FIG. 2.

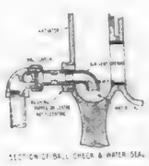


FIG. 3.

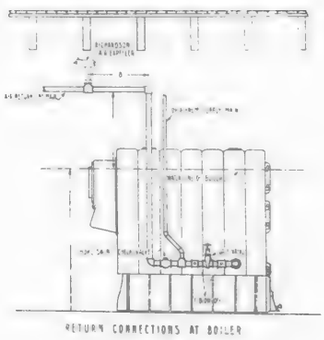


FIG. 4.

FIG. 5.

Supply mains not exceeding 100 lineal feet in length.

Sq. Ft. Radiation	Pipe Size, In. Diam.
150	1½
400	2
600	2½
1000	3
1400	3½
2000	4

Air Return Line Mains

Sq. Ft. Radiation	Pipe Size, In. Diam.
80	¾
200	1
800	1¼
1500	1½
4000	2

Wet Return Mains

Sq. Ft. Radiation	Pipe Size, In. Diam.
400	1
1000	1¼
1800	1½
5000	2

Risers up to 30 lineal ft. high.

Sq. Ft. Radiation	Sup. Riser In. Diam.	Ret. Riser In. Diam.
20	¾	¾
60	1	¾
100	1¼	¾
180	1½	¾

VAPOR HEATING—The Richardson System. No. 132-EE.

Copies of this Data Sheet, printed separately, 5 cents each.

THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. CITY

BOILER CAPACITIES FOR DIRECT RADIATION.

To meet the condition where several types of radiation are installed on the same heating system, together with other kinds of heating load, and at the same time provide for the fact that boiler ratings represent various standards of boiler testing, a chart has been devised by the Chicago Master Steam Fitters' Association, which facilitates the approximate estimating of required minimum boiler capacity.

For computing minimum size of boiler required for the average building, based upon approved ratings specified in the manufacturers' catalogs, the first step is to reduce all radiation to the equivalent amount of cast-iron column radiation. Having totalled this equivalent radiation, find the percent to be added as a factor of safety when building is to be heated from 10° to 70° F., by referring to the chart, reading horizontally according to the key number of the desired type of boiler and vertically according to the total equivalent radiation. Having added this percentage for safety, add the computed equivalent of other heating load and the total gives minimum rated capacity of boiler required.

EXAMPLE

Find the size of steel down-draft, brick-set boiler required for the following installation (Key No. 7 on chart):

(1) 500 sq. ft. of direct cast-iron column radiation in rooms to be heated from 10° to 70° F.
(2) 500 sq. ft. of direct cast-iron column radiation in rooms to be heated from—10° to 50° F.
(3) 500 sq. ft. of cast-iron wall-type radiation, or wall pipe coils (being the equivalent of 625 sq. ft. of cast-iron column radiation) in rooms to be heated from—10° to 50° F.
(4) 500 sq. ft. of indirect radiation
(5) 500 sq. ft. of direct-indirect radiation.
(6) 250 gal. hot water tank. Water to be heated with steam coils.
(7) 500 sq. ft. of cast-iron fan blast radiation, regular sections, 5-in. centers, 1000 ft. velocity, air taken from out of doors—10° to F. T. 80° F. Radiation three stacks deep.

METHOD

(1)	500 sq. ft.	500
(2)	500 sq. ft. plus 13%	565
(3)	500 sq. ft. plus 25% plus 13%	707
(4)	500 sq. ft. plus 50%	750
(5)	500 sq. ft. plus 25%	625
(6)	250 gal. x 2	500
		3647
	Add factor of safety 37.8%	1378
		5025
	(See Key No. 7 and 3700 load, on chart)	
(7)	500 x 1.92 x 4 plus 15%.	4416
	Minimum rated capacity of boiler	9441

(Concluded on Data Sheet No. 49-C)

BOILERS—Boiler Capacities. **No. 49-B**

Copies of this Data Sheet, printed separately, 5 cents each.

THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. CITY

BOILER CAPACITIES FOR DIRECT RADIATION

(Concluded from Data Sheet No. 49-B)

RADIATION LOAD

Key	FACTOR OF SAFETY OVER RADIATION LOAD	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	2500	2600	2700	2800	2900	3000	3100	3200	3300	3400	3500	3600	3700	3800	3900
1		92	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92
2		100	995	99	985	983	98	975	97	965	963	958	953	95	945	94	938	933	928	925	92	915	913	908	903	90	895	89	887	883	878
3		68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68
4		80	798	796	794	79	785	783	779	775	773	77	768	763	76	758	753	75	748	745	743	738	735	733	729	725	723	72	717	713	71
5		75	745	74	735	73	725	72	715	71	705	70	695	69	685	68	675	67	665	66	655	65	645	64	635	63	625	62	615	61	605
6		50	498	495	493	49	488	485	483	48	478	475	473	47	468	465	463	46	458	453	45	448	453	44	438	435	433	43	428	425	423
7		45	448	445	443	44	438	435	433	43	428	425	423	42	418	415	413	41	408	405	40	398	395	39	388	385	383	38	378	375	373
8		40	398	397	395	394	393	391	39	388	387	385	384	383	381	38	378	377	375	374	373	37	368	367	365	364	363	361	36	358	357
9		35	348	347	345	344	343	341	34	338	337	335	334	333	331	33	328	327	325	324	323	32	318	317	315	314	313	311	31	308	307
10		30	298	297	295	294	293	291	29	288	287	285	284	283	281	28	278	277	275	274	273	27	268	267	265	264	263	261	26	258	257

RADIATION LOAD

Key	FACTOR OF SAFETY OVER RADIATION LOAD	4000	4100	4200	4300	4400	4500	4600	4700	4800	4900	5000	5100	5200	5300	5400	5500	5600	5700	5800	5900	6000	6100	6200	6300	6400	6500	6600	6700	6800	6900
1		92	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92
2		875	87	865	863	858	855	85	845	84	837	832	828	825	82	815	81	805	803	798	795	79	787	783	778	773	77	765	76	758	753
3		68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68
4		707	703	70	698	694	691	688	685	682	678	675	673	669	665	663	659	657	655	65	648	643	64	638	634	63	629	625	623	619	615
5		60	598	596	595	593	592	59	588	587	586	585	583	581	58	579	577	575	574	57	571	57	568	566	565	564	562	56	559	558	558
6		42	418	415	413	41	408	405	403	40	398	395	393	39	388	385	383	38	378	375	373	37	368	365	363	36	358	355	353	35	348
7		37	368	365	363	35	358	355	353	35	348	345	343	34	338	335	333	33	328	325	323	32	318	315	313	31	308	305	303	30	298
8		355	354	353	351	35	348	347	345	343	341	34	338	337	335	334	333	331	33	328	327	325	324	323	321	32	318	317	315	314	313
9		305	304	303	301	30	298	297	295	293	291	29	288	287	285	284	283	281	28	278	277	275	274	273	271	27	268	267	265	264	263
10		255	254	253	251	25	248	247	245	243	241	24	238	237	235	234	233	231	23	228	227	225	224	223	221	22	218	217	215	214	213

NOTE—No boiler to be installed having grate longer than 72"

RADIATION LOAD

Key	FACTOR OF SAFETY OVER RADIATION LOAD	7000	7100	7200	7300	7400	7500	7600	7700	7800	7900	8000	8100	8200	8300	8400	8500	8600	8700	8800	8900	9000	9200	9400	9600	9800	10000	10200	10400	10500	10600
1		92	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92
2		75	745	74	735	73	728	723	72	715	71	705	701	699	693	69	685	68	675	673	669	665	66	655	65	647	643	64	638	636	633
3		68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68
4		613	608	606	603	60	596	593	59	586	583	58	578	574	57	568	563	561	558	555	551	548	545	542	539	536	533	531	53	528	526
5		554	552	55	549	548	547	546	545	543	541	54	538	536	535	533	531	53	529	527	525	524	523	52	519	517	516	515	515	514	513
6		345	343	34	338	335	333	33	328	325	323	32	318	315	313	31	305	30	298	295	293	29	289	288	286	285	278	276	273	273	273
7		295	293	29	288	285	283	28	278	275	273	27	268	265	263	26	255	25	248	245	243	24	239	238	236	235	228	226	225	224	223
8		306	304	303	301	299	298	296	295	293	292	29	289	287	285	283	282	28	279	277	275	274	273	271	27	269	266	265	264	264	263
9		256	254	253	251	249	248	246	245	243	242	24	239	237	235	233	232	23	229	227	225	224	223	221	22	219	216	215	214	214	213
10		206	204	203	201	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20

RADIATION LOAD

Key	FACTOR OF SAFETY OVER RADIATION LOAD	11000	11200	11400	11600	11800	12000	12200	12400	12600	12800	13000	13200	13400	13600	13800	14000	& Over
1		92	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92	
2		633	63	628	625	623	621	62	618	615	613	612	608	606	605	603	60	60
3		68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68
4		525	523	522	52	518	516	515	513	512	51	508	507	506	505	503	50	50
5		512	512	511	51	509	508	507	506	505	505	504	503	503	502	501	50	50
6		27	269	268	267	266	265	264	261	26	259	258	256	255	253	251	25	25
7		22	219	218	217	216	215	214	211	21	209	208	206	205	203	201	20	20
8		262	261	26	26	259	258	257	256	256	255	255	254	253	252	251	25	25
9		212	211	21	21	209	208	207	206	206	205	205	204	203	202	201	20	20
10		20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20

NOTE—No boiler to be installed having grate longer than 72"

The key numbers given on the chart refer to boilers of the following types:

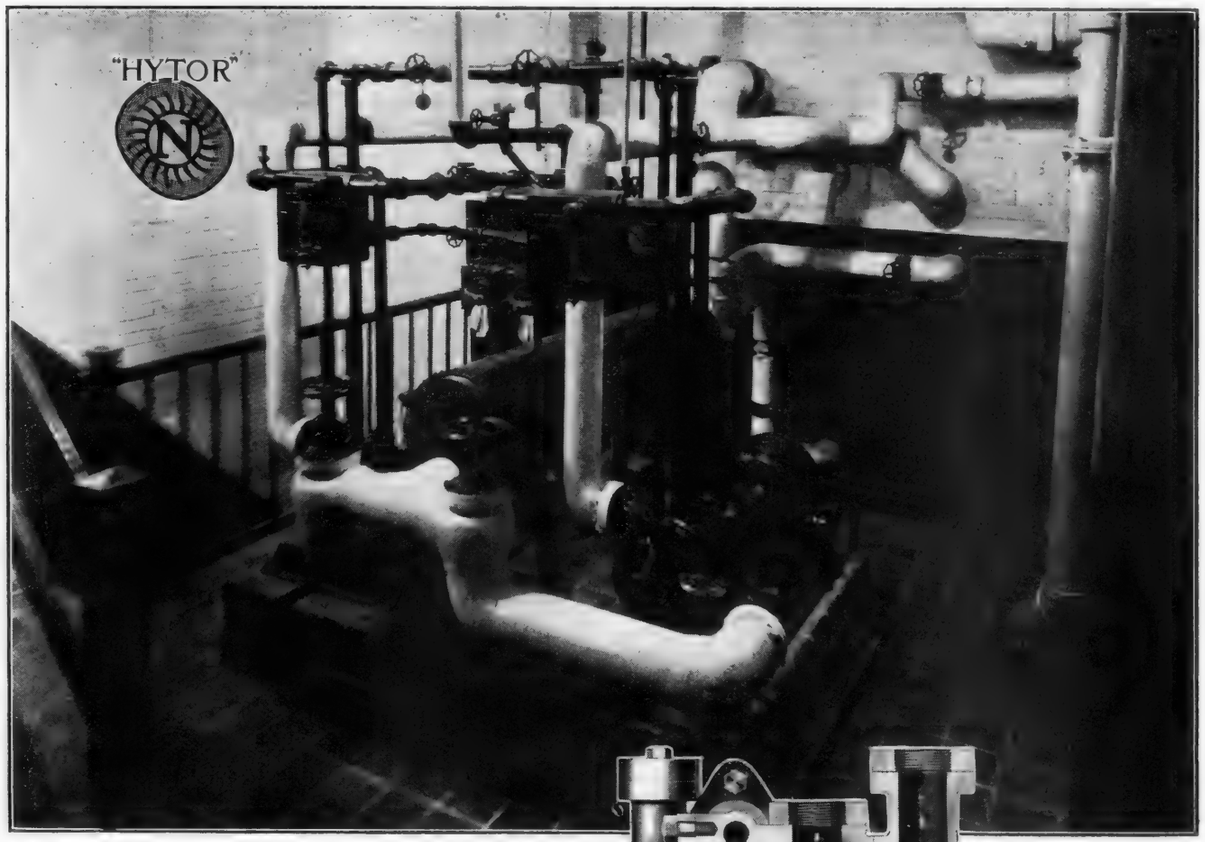
KEY

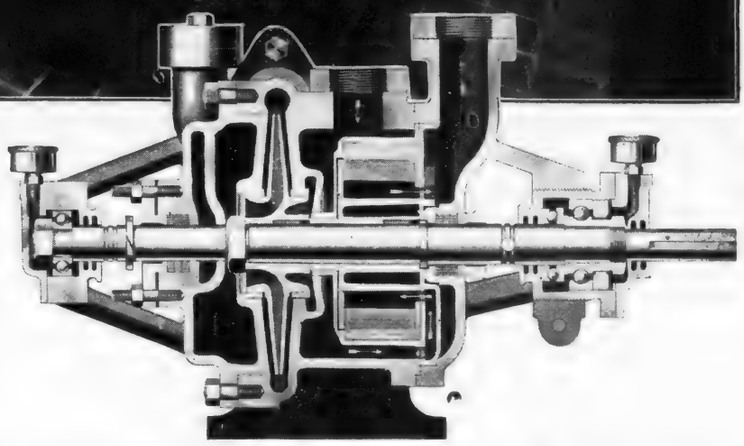
1—American Radiator Co., type "C"
2—Bryant Heater & Mfg. Co., gas boiler
2—Cast-Iron up-draft
3—American Radiator Co., type "A"
4—Cast-Iron Smokeless (approved type)
5—Cast-Iron, magazine type
6—Oil City portable
6—Pacific portable
6—Herbert down-draft
7—Kewanee smokeless
8—Herbert up-draft
9—Kewanee up-draft
10—Kewanee up-draft with approved arch.

BOILER CAPACITIES. No. 49-C

Copies of this Data Sheet, printed separately, 5 cents each.

EFFICIENT HEATING *demands the* JENNINGS PUMP





Duplex "D" Unit Continuous Operation

BORDEN BUILDING
Madison Avenue and 45th Street
New York City

Capacity each pump 40,000 square feet direct radiation; air capacity 25 cubic feet per minute in addition to a water capacity of 60 gallons per minute.

The motors are only three horse power.

THE Jennings Pump consists of two independent turbine units, an air pump and a water pump. As each material is handled separately, the boiler pressure is against the water only. The air and vapor, approximately four-fifths of the volume handled, are delivered to the atmosphere without back pressure. The saving in horsepower is over fifty per cent. In other words, the current to operate is cut in half.

Because of its compact design, this equipment can be installed in less than one-third the space necessary with other apparatus. All interior parts are bronze, supported on annular ball bearings mounted outside of casing. Moving parts revolve without contact.

A quiet, reliable operation with minimum expense for repairs and without annoyance because of shut-downs, is assured if the Jennings Pump is installed on your Vacuum Heating System.

There are many other reasons why the Jennings Pump is being installed in practically all of the important buildings. Bulletin No. 15 gives them in detail. Write for it.

THE NASH ENGINEERING COMPANY

SOUTH NORWALK, CONN., U. S. A.

TRADE AND MISCELLANEOUS NOTES

Coming Events.

January 24-26, 1922—Annual Meeting of American Society of Heating and Ventilating Engineers, in New York. Headquarters at Engineering Societies Building.

Miscellaneous Notes.

Washington, D. C.—Business conditions continue to show a moderate improvement in nearly all sections of the country, reports Archer Wall Douglas, chairman of the Committee on Statistics and Standards of the Chamber of Commerce of the United States, in his monthly review of the business situation.

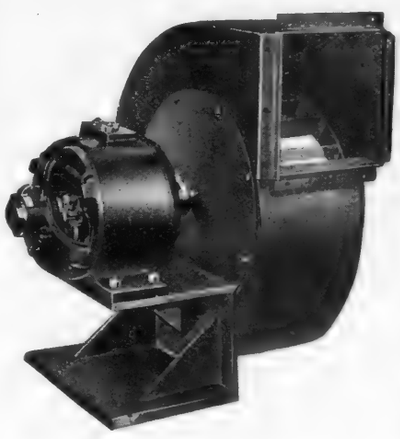
Associated General Contractors of America announce the launching of a national campaign to start a construction program as outlined by the National Unemployment Conference. Meetings have been arranged in the principal cities of the country which will be addressed by members of the executive board of the association to discuss ways and means of getting the construction program under way. To start the work, central committees of general contractors in each of the cities will be appointed as nuclei of a permanent organization. The organization of local conference boards representing architects, engineers, contractors and labor, to handle local jurisdictional disputes and other local construction problems will be recommended. Local committees will be urged to secure the Fall letting of public work and highway contracts.

Franklin Union Heating and Ventilating Association, of Boston, Mass., consisting of heating and ventilating engineers and contractors, held its outing this year at Ferncroft Inn., Hawthorne, Mass., where a chicken and lobster dinner was served. Following the dinner a program of sports was carried out, including a ball game between the engineers and contractors. This was won by the engineers after twelve exciting innings, by a score of 2 to 0.

Engineering Institute of Canada will hold its annual general meeting in Montreal, Canada, January 24, 1922. This meeting will be adjourned to Winnipeg, February 21-23, where the annual general professional meeting will be held under the auspices of the Winnipeg Branch of the institute.

Mortimer E. Cooley, dean of the Colleges of Engineering and Architecture of Michigan and past president of the American Society of Mechanical Engineers, has been elected president of the Federated American Engineering Societies, succeeding Herbert Hoover. It is stated that Dean Cooley will devote one-fourth of his time to the work of the F. A. E. S. At the meeting of the executive board at which this action was taken, a resolution was proposed by W. W. Varney, of Baltimore, providing for the publication of a journal by the Federated Societies. The proposed resolution was referred to the committee on printing.

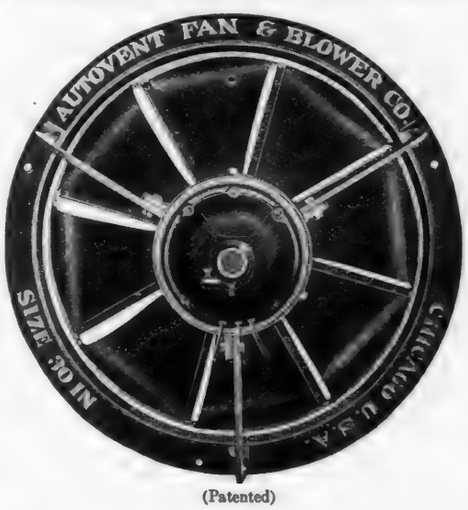
Washington, D. C.—Because of the limited appropriation for printing and the great demand for copies of the "Survey of Current Business," it has been necessary to put this publication on a subscription basis, the price being fixed at 10 cents a copy and $1.00 a year. Subscriptions should be addressed to the Superintendent of Documents, Washington, D. C.



Regardless of Weather Conditions, There Is Always a Demand for Adequate and Efficient Ventilating Equipment. This Demand Is Not Affected by the Change in Seasons, as Fans and Blowers Are Just as Urgently Required During the Fall and Winter Months as During the Summer Season.

Autovent Fan and Blower Products

Are used extensively on many different applications, such as for heating, drying and exhausting; for ventilation in schools, churches, hotels, restaurants, and in fact, every place where people congregate for either work or play



(Patented)

If you have not considered the wonderful sales possibilities of the Autovent Fan and Blower line, now is the time to get full particulars regarding the progressive merchandizing policy that we have inaugurated.

Our detailed plan of how we are co-operating with heating and ventilating contractors, in assisting them to develop a highly profitable volume of business through the sale of Autovent Fans and Uniblade Blowers will be forwarded on receipt of your request.

AUTOVENT FAN AND BLOWER CO.

Formerly
BATTERMAN-TRUITT COMPANY

Branch Offices in All Principal Cities

General Offices and Works, 730-738 W. Monroe St., Chicago

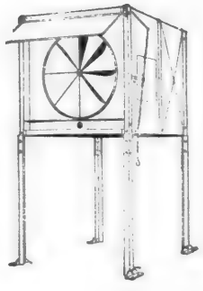
"Perfect Package Month" is the slogan of a movement that has been inaugurated by the railroads, steamship lines and express companies in the United States and Canada. November has been designated as the "perfect package month." The purpose of the movement is to stimulate further public interest in the good packing of shipments and to enable the carriers to improve the transportation service of the country. Comparisons of the records made by the various cities during November will be announced at the conclusion of the drive.

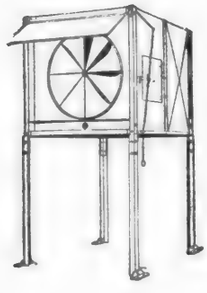
American Gas Association held its annual meeting in Chicago, November 7-12. In commenting on the meeting, President Charles A. Munroe said: "Today there are more than 1200 industrial uses for gas which, however, has reached only its preliminary uses. The future lies ahead. It is not drawing too much on the imagination to visualize a time when solid fuel will no longer be used in populated areas, when coal strikes, transportation difficulties, scarcity and consequent abnormal prices will have lost their terrors for the individual fuel user."

National Association of Practical Refrigerating Engineers will hold its twelfth annual convention in Philadelphia, November 30—December 3, 1921, with headquarters at the Hotel Lorraine. This is the first meeting of the association to be held in the East. The Educational and Examining Board of this association has recently had prepared under its supervision a lecture course on "The Principles of Refrigeration," in twenty parts, for the benefit of its members. Starting with Lecture No. 1, the course is sent to them at intervals of two weeks. The national secretary of the association is Edward H. Fox, 5707 West Lake Street, Chicago, Ill.

Federal Board for Vocational Education announces that "The Vocational Summary," which has been issued monthly by the board since May, 1918, has been discontinued with the issue of July, 1921. It stated that the suspension of the publication, which is due to lack of available funds, is considered by the board as a temporary measure.

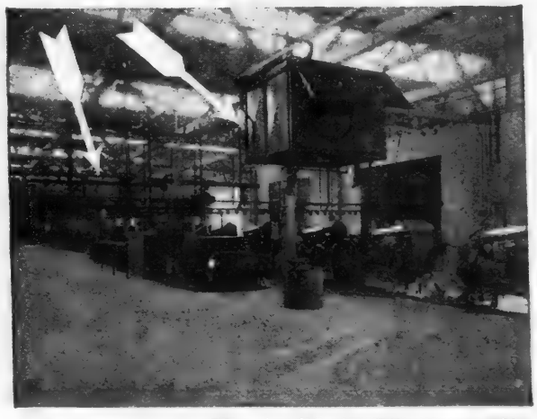
A PROFITABLE 24 HOUR HEATING CHART





ILGAIR UNIT HEATERS

Here is the conclusive answer to the Most Important Problem of Industrial America. A method of heating where the cost is measured by the hourly working schedule.



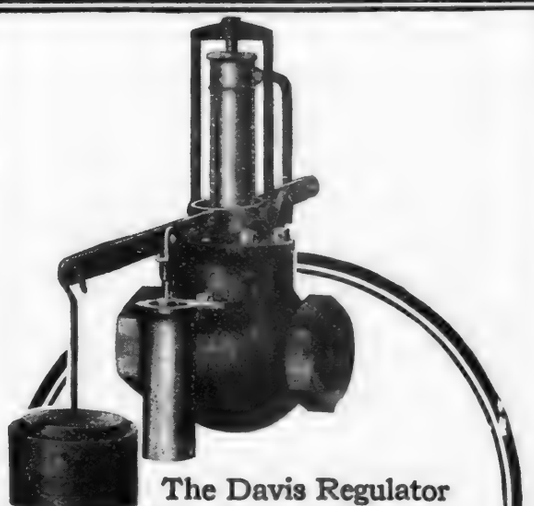
Ilgair Unit Heaters distribute heat at the floor where it belongs at a cost that represents considerable saving

HEAT EFFECTIVELY IN WINTER AND COOL PLEASINGLY IN SUMMER

Send for Circular

ILG ELECTRIC VENTILATING CO., 2858 N. Crawford Ave., Chicago, Ill.

BRANCHES IN ALL LARGE CITIES.



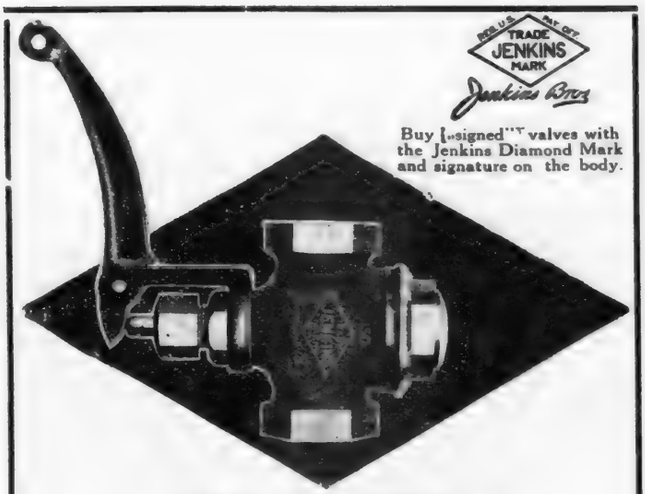
The Davis Regulator

has a wide use in heating plants. It reduces high pressure steam to the lower pressures needed for heating systems. And it does its work dependably, accurately, with very little attention or repairs—all Davis characteristics.

Write the G. M. Davis Regulator Co., 436 Milwaukee Ave., Chicago, for the catalog that describes Davis Steam Savers for heating plants.

DAVIS VALVE SPECIALTIES

STEAM SAVERS SINCE 1875



REG. U.S. PAT. OFF. TRADE JENKINS MARK Jenkins Bros

Buy "signed" valves with the Jenkins Diamond Mark and signature on the body.

BRASS QUICK-OPENING, SELF-CLOSING WHISTLE VALVE

Usually termed "whistle" valve because extensively used to operate steam or air whistles, but now also widely used on steam, water or air lines whenever a dependable, quick-opening, self-closing valve is desired. Opened wide by pull of lever, giving instant, full flow—valve closes automatically as soon as lever is released.

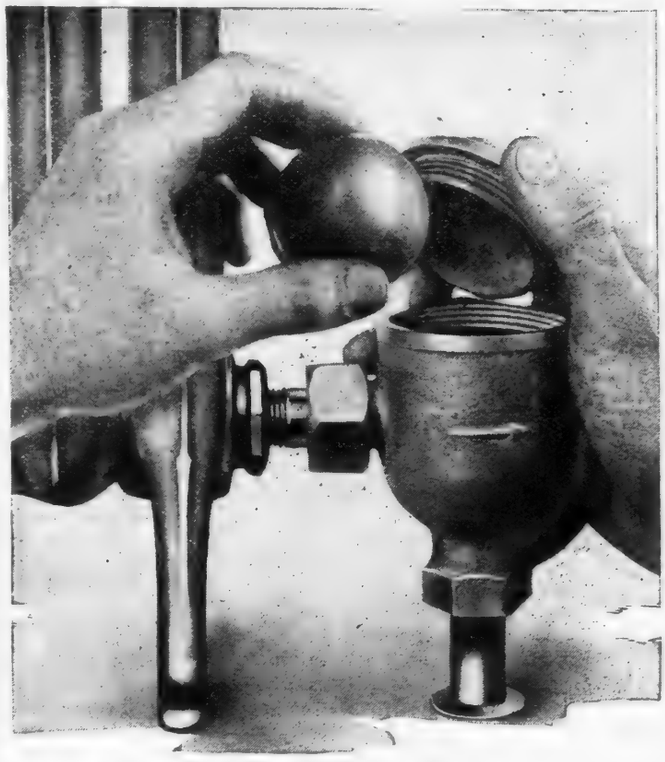
At supply houses

JENKINS BROS.

New York Boston Philadelphia Chicago
Montreal London Havana

FACTORIES: Bridgeport, Conn.; Elizabeth, N. J.; Montreal, Canada.

Jenkins Valves SINCE 1864



Drop in the ball and the job is done

BOTH contractors and owners realize the nuisance and expense of traps that misbehave. This fact alone is a strong argument for the mechanical simplicity of the Johns-Manville Radiator Trap. This trap has just one moving part—an unattached, floating metal ball.

The trap is tinker-proof; it needs no adjusting. Clean it once in a while and leave the rest to the floating ball.

The price of the Johns-Manville Radiator Trap will surprise you agreeably. Write for the booklet.

How it works

When water enters the trap it raises the floating ball. This uncovers the discharge outlet, and water and air flow out of the trap.

When the water level drops, the ball rolls down and again covers the discharge orifice, preventing the loss of steam.

JOHNS-MANVILLE
Incorporated
Madison Ave. at 41st St., N. Y. City
Branches in 60 Large Cities
For Canada:
CANADIAN JOHNS-MANVILLE CO., Ltd., Toronto

Through—

Asbestos

and its allied products

JOHNS-MANVILLE
Serves in Conservation

Heat Insulations, High Temperature Cements, Asbestos Roofings, Packings, Brake Linings, Fire Prevention Products

JOHNS-MANVILLE Radiator Trap

Cleveland, O.—Cleveland's new $5,000,000 municipal auditorium will be opened January 4 of next year by the American Building Exposition, sponsored by the Builders' Exchange and to run eleven days. Planned along the lines of London's biennial "Ideal Home Show" it will depart radically from the usual exposition in that it will not be for profit. Earnings will be rebated, pro rata, to the exhibitors.

Both the exposition hall and the auditorium proper will be utilized. The latter, with its ceiling height of 60 ft., will be used exclusively for structural materials, landscaping, financing, engineering, architecture and real estate. The exposition hall will house exhibits of interior trim, decoration, equipment, and in fact all that goes within the home or commercial building, together with contractors' machinery and equipment.

Incidental to the exposition there will be a number of conventions drawn expressly on its account. Definitely announced so far are those of the Associated General Contractors, the National Federation of Construction Industries and the Ohio Association of Builder's Exchanges.

Ralph P. Stoddard is director general of the exposition and Richard G. Collier is assistant manager. Both were associated with the initial Cleveland building show which scored such a tremendous success six years ago. Included among the directors of the American Building Exposition is T. G. Mouat, of the Mouat-Squires Company, manufacturer of the Mouat line of heating specialties.

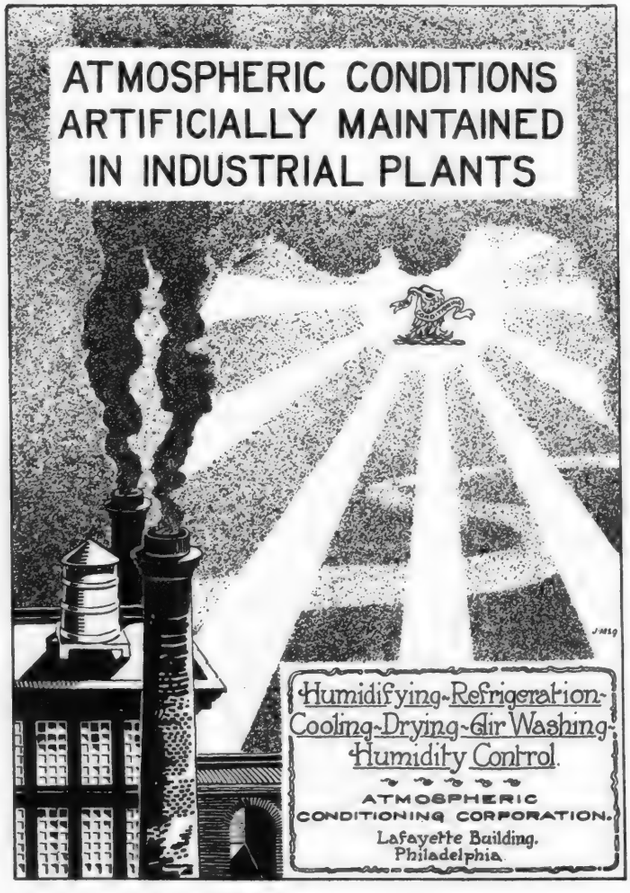
Topeka, Kan.—A special board of engineers appointed from the engineering staff of Kansas University and Kansas State Agricultural College will have charge of making the plans for the new power plant and mine electrification system at the State penitentiary. Dean E. F. Walker of Kansas University Engineering School, is chairman of the board.

International Chamber of Commerce will hold its second annual meeting in Rome, Italy, during the week of September 22, 1922. At the first annual meeting held last June in London more than 200 American business men, representing virtually every industry in the United States were present.

Chicago, Ill.—The Chicago Building Trades Council has voted unanimously to reaffirm the recent wage decision handed down by Judge K. M. Landis, who was the arbiter in the wage controversy in that city. The carpenters and plumbers, it is announced, also concurred in the decision. This, it is believed brings near the day when the $60,000,000 worth of construction work in Chicago, which has been held up so long, will be released.

Building Operations during September in the 27 northeastern States, according to the F. W. Dodge Company, amounted to $246,186,000. This is not only the largest monthly total that has been reached this year, but it is also the largest September figure on record. The September total shows an increase of 11½% over the August figure. Although the greatest increase in September was evident in the New York district, substantial increases are noted in the entire middle western territory, comprising the Pittsburgh and Chicago districts. New England, the northwestern States and the middle Atlantic States showed the usual seasonal decline in September. Residential building still leads, amounting to $95,303,000 in September, or 39% of the total September construction. Of even greater significance at the present time is the increase in the volume of business buildings. The September figure was $41,259,000 the largest total monthly total on this class since June, 1920. Business buildings represented 17% of the September total. Construction was started on a number of long-deferred projects of this kind in September.

In the New England States September building contracts amounted to $16,026,000, 22% less than August. New York State and northern New Jersey reported the record-breaking figure of $85,900,000, an advance of 41% over the previous month. The middle Atlantic States showed a decrease of 10%, the central west a slight increase of 3% and the northwest a decrease of 16%. In the Pittsburgh district the total was $40,885,000, an increase of 24% over August.



More in Your Favor
—with
Mel-Rock Air Washers

MEL-ROCK Air Washers possess many exclusive points of advantage, which are of high value. For instance:

EACH CAPACITY is made in from four to seven different proportions, so that any space and head-room may be accommodated.

MEL-ROCK Eliminator Systems are made in batteries, riveted at the factory. This saves you considerable time and money in setting up.

MEL-ROCK Mist Nozzles discharge a greater volume of mist, at low pressure.

MEL-ROCK stands .or the very highest development in air-washing efficiency and economy.

Send for descriptive catalog.

TO AGENTS—There is still some good, exclusive territory open. Write for particulars.

MELLISH-HAYWARD
COMPANY
213 West Austin
CHICAGO

Cleveland's Pride

Clark, Mc Mullen & Riley
Consulting Engineers

J. H. Mac Dougall
F. R. Walker
} Architects

"Buffalo"

Cleveland's Public Auditorium, which is fast nearing completion, marks the first step toward one of the finest groups of public buildings in America.

Built to endure they will serve as a lasting tribute to the civic spirit that has aided so materially in the rapid growth of America's cities.

We are proud that Buffalo Fans and Carrier Air Washers were chosen to handle the entire Heating and Ventilating for Cleveland's Public Auditorium.

Every Heating and Ventilating Engineer should have our catalog 700-36.

Buffalo Forge Company

Buffalo **New York**

New York Boston Philadelphia Pittsburgh Cleveland Chicago Los Angeles

Manufacturers' Notes.

York Heating and Ventilating Corporation, Philadelphia, Pa., announces that Thornton Lewis, formerly of the Buffalo Forge Company, is now identified with the corporation as vice-president and general manager. During the war period Mr. Lewis was consulting engineer for the DuPont Companies of Wilmington, Del., having charge of the design and supervision of all heating, ventilating and drying installations. He is a member of the executive committee in charge of the heating engineers' Research Laboratory in Pittsburgh and also represents the heating engineers' society and the American Society of Mechanical Engineers on the Building Code Committee appointed by Secretary Hoover to standardize various building codes throughout the United States. The York Heating and Ventilating Corporation, which specializes in the design and installation of complete heating, ventilating and dust exhaust and recovery systems, has recently acquired a new plant in Bridgeport, Pa., containing 50,000 sq. ft. of floor space where it manufactures many of the products used in its work.

Goetze Gasket & Packing Co., New Brunswick, N. J., has opened a branch office in Philadelphia, under the management of the Sheffler-Gross Company. The new branch is located in the Drexel Building, Fifth and Chestnut Streets.

Drying Systems, Inc., Chicago, Ill., has appointed Burt S. Harrison, formerly of the Carrier Engineering Corporation, to its engineering staff. Mr. Harrison will specialize in high-temperature work and drying. His many years of experimental work and practical experience in this field have established his reputation as one of the few authorities in this country on high-temperature drying.

United States Radiator Corporation, Detroit, Mich., has established a new assembling plant in Indianapolis, Ind., where the company has leased a building for this purpose, 50x150 ft., on Senate Avenue, now under construction. Harry L. Repp is manager of the Indianapolis branch.

Crane Co., Chicago, Ill., is building a five-story plant in New Orleans, to cost $1,000,000. The location is on South Front Street.

Hoffman Specialty Co., Waterbury, Conn., manufacturer of the Hoffman line of steam and vapor heating specialties, has moved its general offices to the Waterbury National Bank Building, in that city.

Kelly & Jones Co., Pittsburgh, Pa., has purchased a two-story brick and concrete building at 2436 West Fifteenth Street, Chicago, where its Chicago branch will be established as soon as alterations and additions are completed. The building contains 50,000 sq. ft. of floor space, and an additional building, soon to be started, will be 70x200 ft.

Files Engineering Co., Inc., Bridgeport, Conn., is planning to establish a department for the manufacture of temperature controlling systems for use in mechanical drying plants.

Niagara Radiator & Boiler Co., No. Tonawanda N. Y. is about to build a plant in Chicago at East 83rd Street and Woodlawn Avenue. The building permit has been issued for this work, in spite of a protest signed by 1200 residents of Avalon Park, which is near the factory site.

Pierce, Butler & Pierce Mfg. Corporation, New York, has appointed P. M. Beecher as a member of its sales force. Mr. Beecher was formerly vice-president of the Pierce, Butler & Pierce Mfg. Company, retaining that position up to the time of the reorganization of the company under its present title a few years ago. He has received a warm welcome from his many friends in the trade who feel an added satisfaction in knowing that the orders they place through him are in such experienced hands.

Charles H. Bishop, formerly one of the editors of *Domestic Engineering,* of Chicago, has entered the heating and plumbing specialty business under his own name, with quarters at 1423 Rosemont Avenue, Chicago.

National Radiator Co., Johnstown, Pa., has appointed Samuel L. Moore as

THE DOUGLASS HUMIDIFIER

STANDARD TYPE
Made in three sizes for direct connection to steam piping

Is attached directly to the steam heating system

Discharges dry steam noiselessly

Gives satisfactory results in any type of building equipped with steam

Inexpensive to install

Will not get out of order

No attention required

No maintenance expense

Made in various sizes and types to suit all conditions and requirements

Illustrated catalogue sent on request

THOMAS J. DOUGLASS & CO.
441 N. Dearborn St.
Chicago, Ill.

RADIATOR TYPE
Is attached to steam radiator in place of the air valve. Made in one size only.

BUILDINGS OF THE MICHIGAN CARTON CO., Battle Creek, Mich.
H. D. Prather, Consulting Engineer, Cleveland, O.

The Michigan Carton Company

Is one of the country's largest producers of cardboard cartons. Their plant is a model in the paper industry.

As a prominent factor

in the production of the high quality cartons they make, Sirocco equipment does full duty throughout their plant.

"Sirocco"
TRADE MARK.

In the power plant

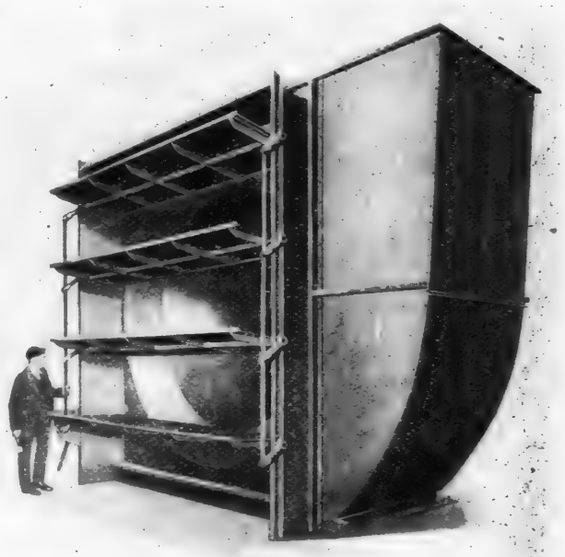
a Sirocco Induced Draft Fan produces draft for the 2700 Horse Power Boilers. In the machine room two enormous paper machines are equipped with Sirocco Fans for carrying away the steam from the drying web of paper and maintaining the proper circulation of air.

Wherever there is

a heating and ventilating problem to be considered there is a type of Sirocco fan, blower, engine or air washer to fill the need.

Heating and Ventilating

engineers are invited to get in touch with one of our offices on problems to be considered along the above lines.



Inlet side of Induced draft fan for Michigan Carton Co., Battle Creek, Mich.

American Blower Company

Detroit, Mich.

manager of manufacturing, in charge of all its plants. Mr. Moore was for a number of years manager of the Bond plant of the American Radiator Company and more recently superintendent of the Whiting Foundry & Equipment Co., of Harvey, Ill.

Fulton Co., Knoxville, Tenn., manufacturers of the Sylphon line of steam specialties, has appointed C. E. White as sales manager of the company. Mr. White was formerly sales manager of the Sterling Mfg. Company, of Cleveland.

Bridgman Bros. Co., Philadelphia, Pa., has purchased the heating and plumbing supply business of Roe & Conover, in Newark, N. J., and has established branch offices there. C. M. Pierce, formerly with the American Radiator Company, in Buffalo, has been appointed manager of the new branch.

Business Opportunity.

Albany, N. Y.—New York State Civil Service Commission announces that a position is open for a heating engineer on design and construction work. Salary, $2200 a year. Open only to residents of New York State. Application must be filed on or before November 23, 1921. For application form and details address the New York State Civil Service Commission, Albany, N. Y.

Central Station Heating Notes.

Terre Haute, Ind.—A rehearing was granted to the Citizens Mutual Heating Company in regard to the flat heating rate which was decided upon at the first hearing of the question before the public service commission a few weeks ago. The company presented evidence to show that it could not afford to furnish heat on the scale in effect and asked to be allowed to retain the old rate of 35 cents per 1000 lbs. of condensation for the first 3000 lbs., the rate dropping 1 cent for each additional 1000 lbs. until it reached 32 cents.

Charleston, Ill.—A resolution was passed recently by the city council calling upon the Central Illinois Public Service Company to furnish steam heat to the inhabitants of Charleston. Just what such a resolution will come to is problematical, as the heating division of the company has secured permission from the State utilities commission to discontinue the heating service. The mains, however, are still intact, although a number of former users have recently installed independent heating systems in their buildings.

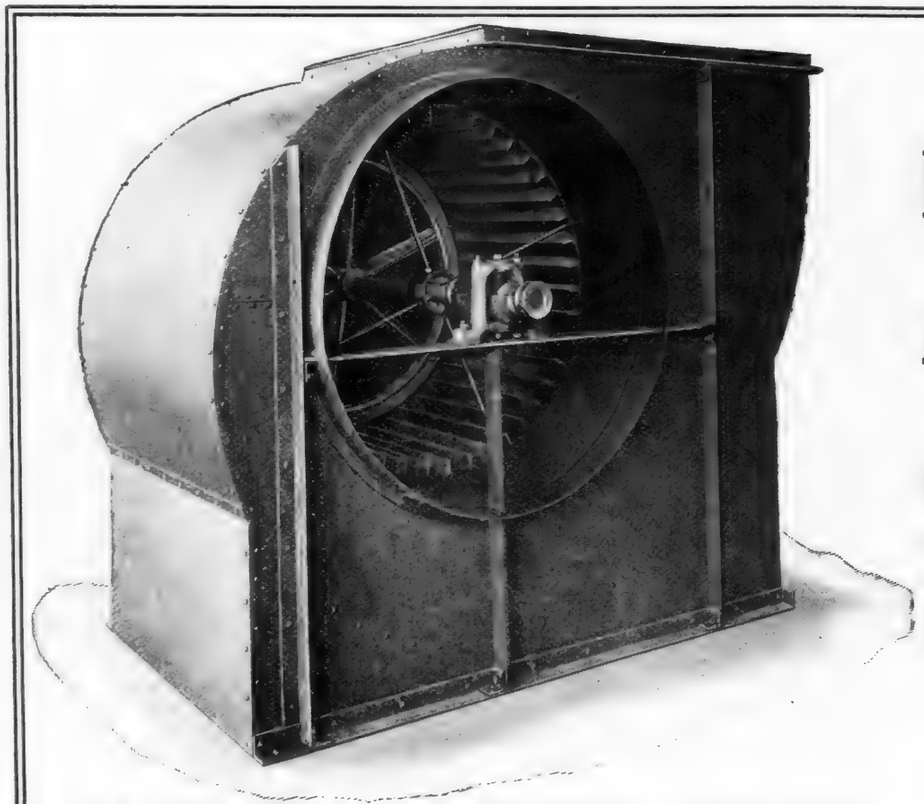
Tuscola, Ill.—At a meeting of the patrons of the public heating service recently it was agreed to lease the heating plant from the Central Illinois Public Service Company and operate it during the coming winter or until individuals can make arrangements for heating on a co-operative plan. The service will be furnished to the patrons at actual cost.

Coshocton, O.—A special ordinance authorizing the employment of an engineer by the city to make an examination of the heating system of the Ohio Service Company, was scheduled for passage at a special meeting of the council called for October 11.

Webster City, Ia.—The Consumers' Heat Company, a mutual organization formed by patrons of the Central Heating Company, now in the hands of a receiver, has been incorporated and articles filed with the county recorder here. The incorporation is for $10,000 divided into shares of $10 each. The purpose of the concern is to operate and maintain a heating plant in Webster City. It will operate the plant of the former central heating company and supply consumers with heat without profit.

Springfield, Mo.—Ground has been broken for a heating plant for the Woodruff building which until this year has been a subscriber of the heating service of the Springfield Gas and Electric Company. The plant which will be located just north of the buildings, will be completed in about 30 days.

Belvidere, Ill.—Swords Bros., of Rockford, Ill., were given the contract for completing the system of heating mains of the Belvidere Heating Company from the railroad tracks on State Street to Whitney Street and Logan



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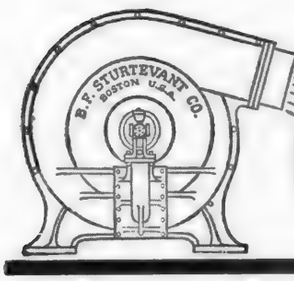
HACKNEY MANUFACTURING COMPANY
SAINT PAUL, MINN.



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The long list of important buildings with Sturtevant equipment is our especial pride. It illustrates the confidence that owners and engineers in every city of the country have in our products and service, and includes buildings of every type. Such long and varied experience insures competent advice and we invite engineers to consult us on their heating and ventilating problems. In each of our twenty-four offices listed below a qualified engineer is ready to serve you.

The Union National Bank Building, Boston, Mass.

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HYDE PARK, BOSTON, MASS.

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MONTREAL 404 New Birks Bldg.
TORONTO 210 Lumsden Bldg.

Avenue. It was expected that the work would be completed sometime in November.

Evanston, Ill.—The Illinois Commerce Commission, which is the new title of the public utilities commission in that state, has suspended an advance in the steam heating rates in Streator, as proposed by the Public Service Company of Northern Illinois, until April 4, 1922.

Batavia, Ill.—A new company, the Batavia Steam Heating Company, has been organized in Batavia, to finance the steam heating proposition for the east side business district, using the exhaust steam from the city plant. Eventually, the city will own the heating system. Practically all of the east side district are members of the company. The company will receive 75% of the revenue derived from the city sale of heat, whether sold to members of the heat company or others. The city will receive 25% of the revenue. Work of laying the steam pipes on both sides of East Wilson Street was expected to start soon. Following are the officers of the new company: President, John Geiss; secretary and treasurer, W. B. Beem. The directors include the two officers named and Samuel Thomle, R. F. Wolcott and William Mair.

New Incorporations.

Providence Radiator & Electric Heating Co., Providence, R. I., capital $2,000,000, to manufacture electrically-heated radiators and other products. Incorporators: Daniel Owen, P. S. Howland and M. A. Colter.

Hamlin Hygrostat Co., New York, capital $20,000, to manufacture air-conditioning equipment and devices for atmospheric regulation. Incorporators: J. A. Hamlin, E. Bernstein and J. T. Mulligan.

Kansas City Boiler & Welding Co., Los Angeles, Cal., organized to manufacture boilers, tanks, etc. Among the principals is Conrad A. Byloff.

Atmospheric Heat & Power Co., Biddeford, Me., capital $1,000,000, to manufacture heating and other apparatus. President, George B. Gordon, Biddleford.

Angster-Stringer Co., Newark, N. J., capital $100,000 to manufacture heating equipment and supplies. Among the principals are: Edward L. Angster, John H. and William A. Stringer, of 224 Bager Avenue, Newark.

Superb Radiator Co., Youngsville, Pa., capital $50,000, to manufacture radiators and other heating equipment. Treasurer, C. P. Cloak, of Youngsville.

Syracuse Oil Burner Co., Syracuse, N. Y., capital $600,000, to manufacture oil-burners and oil-burning apparatus. Incorporators: J. F. Knox, George E. Page and Alfred O. Wilmot.

D. C. Murphy Co., Inc., Davenport, Ia., capital $50,000, to manufacture and install heating, ventilating, refrigerating and plumbing apparatus. President, E. T. Murphy; vice-president, E. J. Dougherty; secretary and treasurer, Jean Murphy. These officers named and Fred R. Pollard and Raymond J. Blank constitute the board of directors.

Standard Boiler Mfg. Co., Brooklyn, N. Y., capital $100,000, to manufacture boilers, tanks and other products. Incorporators: N. Cooper, L. J. Durkore and P. Kaplan.

National Generator Co., New York, capital $500,000, to manufacture steam generating equipment, etc. Incorporators: W. W. Harris, W. C. Swift and S. Null.

W. H. Schroff Fuel Oil Burner Co., Chicago, Ill., organized to manufacture small residential and industrial oil burners. Incorporators: C. V. Kellogg, Fred B. Fiz and William H. Schroff.

Sullivan Boiler & Mfg. Co., Sullivan, Ind., capital $25,000, to manufacture boilers and heating specialties. Incorporators: J. W. Lindley, C. H. Bedwell and W. T. Mellott.

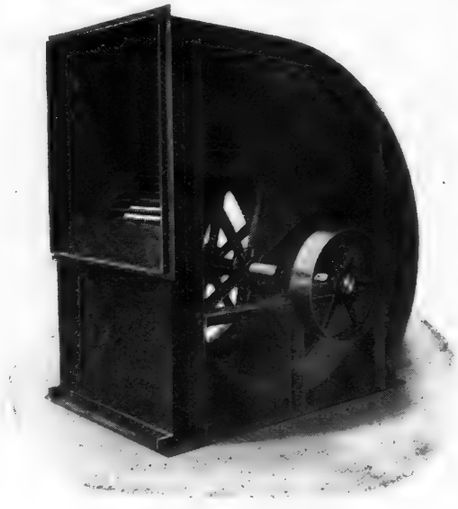
Heaters and Freezers, Inc., Wilmington, Del., capital $40,000, to manufacture heating and other equipment. The new company is represented by the Corporation Trust Company of America, Du-Pont Building Wilmington.

Breeze & Bettle, Chicago, Ill., capital $20,000, to manufacture small boilers for house heating, including types adapted to oil burning. The boilers are now being manufactured by the National Machine Company. President, Griscom Bettle; secretary, J. A. Murray.

James Robertson Mfg. Co., Richmond, Va., capital $350,000, to manufacture pipe and steam specialties, gas

Buckeye Multiblade Fans

are made especially for low pressure Heating and Ventilating work. They are giving perfect satisfaction.



CORRECT DESIGN, HEAVY CONSTRUCTION, NOISELESS OPERATION, WORKMANLIKE FINISH, HIGHEST EFFICIENCY.

Our Engineering Department is maintained for the purpose of assisting Engineers, Architects, etc., in planning efficient Heating and Ventilating Systems for all buildings.

THIS DEPARTMENT IS FREE TO YOU

We also manufacture a complete line of Disc, Cone and Steel Plate Fans:

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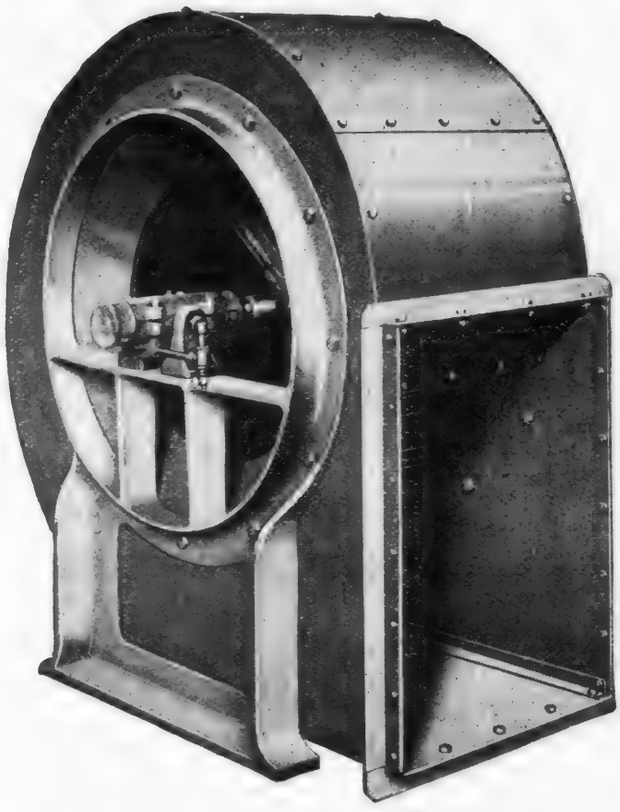
BUCKEYE BLOWER CO.

COLUMBUS, OHIO

The New York Blower Company

SERI-VANE FANS



Cut shows our standard type "C" Seri-Vane Fan as made in all sizes to and including number six—wheel diameter 36 inches. You will note fan is reversible as to both hand and discharge. Any special angular discharge can be readily attained with a minimum of labor. We stock all sizes of these fans so can ship any hand or discharge within twenty four hours from receipt of order at our factory.

Are you using our Mushroom Ventilators? If not, write for prices and literature and save labor of your men and your money.

THE NEW YORK BLOWER COMPANY

513 Transportation Building

CHICAGO, ILL.

Factory: Laporte, Ind.

For prompt service, write nearest sales office

fitting supplies, etc. The company will operate a plant in Richmond. Manager, Louis Miller.

Jefferson Heating Co., 5547 Leland Ave., Chicago, Ill., capital $1,000, to deal in pipes, radiators, heating apparatus and plants. Incorporators: Robert Freebus, Harry Shepard and Johanna Gartleman. Correspondent, Golden & Sullivan, 127 North Dearborn Street, Chicago.

Contracts Awarded.

Ottumwa, Ia.—General Heating and Ventilating Co., of Milwaukee, was awarded the heating contract for the new High School in Ottumwa, at its bid of $54,253. The ventilating contract went to the Mesaba Sheet Metal Works, Virginia, Minn., at its bid of $51,975. Temperature control, Johnson Service Co., Milwaukee, $11,250; pipe covering, Keasbey & Mattison Co., Chicago, $8,500; plumbing, Western Heating Co., Minneapolis, $42,935.

Topeka Engineering Corporation, Topeka, Kan., which was recently organized, was the successful bidder at $7,720.15 for the heating, ventilating and plumbing of the new Home Economics and Cafeteria Building at the Kansas State Agricultural College. Other bidders were: Patterson & Co., Topeka, $9,808; Salina Plumbing Co., Salina, $10,900; W. F. Sheahan, Topeka, $11,400; Obenland Brothers, Manhattan, $9,250; M. M. Stevens, Hutchinson, $10,300; Johnson & Beck, Topeka, $9,915.

Seattle, Wash.—Bids were received as follows for the heating and ventilating of the Gatewood School, the lowest ones being considerably below the estimates of School Architect B. F. Naramore: West Coast Heating Co., $23,697 (awarded the contract); this firm also obtained the plumbing contract at its bid of $8,899; Hellenthal Plumbing & Heating Company, $24,250; King Plumbing & Heating Company, $26,900; P. J. Lavan, $23,760; McMahon Plumbing & Heating Co., $25,621; Norton & Spangler, $24,091, J. A. Scherer, $24,154; University Plumbing & Heating Co., $24,600, Wenzler & Ward, $24,685.

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Advertisements under this heading, $2.00 per inch, payable in advance. A 1-in. advertisement contains 35 words. To secure insertion copy must be received not later than the 20th of the month preceding date of issue.

Position Wanted.—Mechanical engineer, twelve years' New York experience estimating and superintending heating and ventilation and sprinkler system installations, desires to connect with a wide-awake contracting firm or architect. Address Metropolitan, care of Heating and Ventilating Magazine.

Wanted.—Sales representative in greater New York, by manufacturer of cast-iron boilers. Applicant should be capable of initiative and assuming responsibility. Apply, stating qualifications, experience, etc., to Manufacturer, Box, 18, care of Heating and Ventilating Magazine.

Wanted.—A capable heating engineer for position with manufacturer of heating apparatus. Position requires both engineering and sales ability. Apply to Wilkinson, Box 10, care of Heating and Ventilating Magazine.

Vento Return Line Valve

for Vacuum and Vapor Heating Systems is a fuel-saver from the moment that it is put to work on the heating system. It never fails in its promise to make the heating system give dollar-for-dollar service for every ounce of fuel consumed.

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The Lehigh catalog is replete with information and data valuable to fan users. Your copy will be sent upon request.

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New York's finest are Westinghouse Equipped

Should you select a list of New York's newest and finest buildings you would find all of them users of Westinghouse motors and control.

The four shown here would be on your list, the Cunard Building being one of the most costly structures in the United States and New York's latest skyscraper.

Below are listed a few more of the most recent buildings erected in New York; all are equipped with Westinghouse apparatus.

Each one of these installations is a guarantee of Westinghouse reliability.

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13 MASSACHUSETTS FANS

INSTALLED IN THIS BUILDING

WOOLWORTH BUILDING NEW YORK CITY

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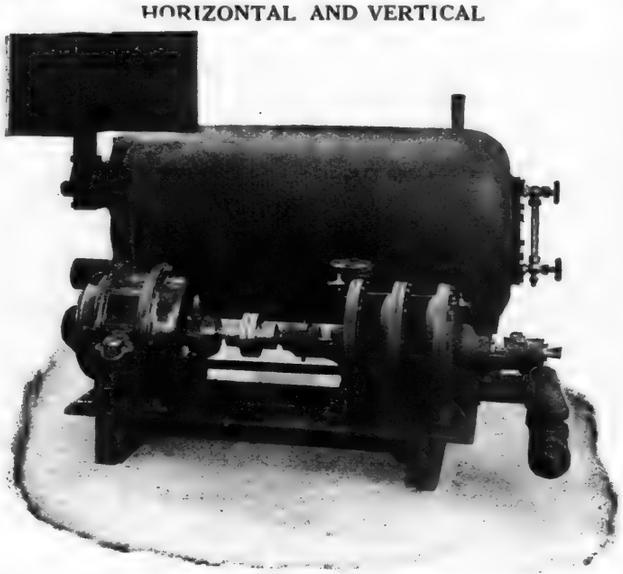
ELECTRICALLY OPERATED
CONDENSATION RETURN PUMPS
HORIZONTAL AND VERTICAL



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RUGGED **RELIABLE**

Constructed to insure long life.
Superiority proven by years of experience.

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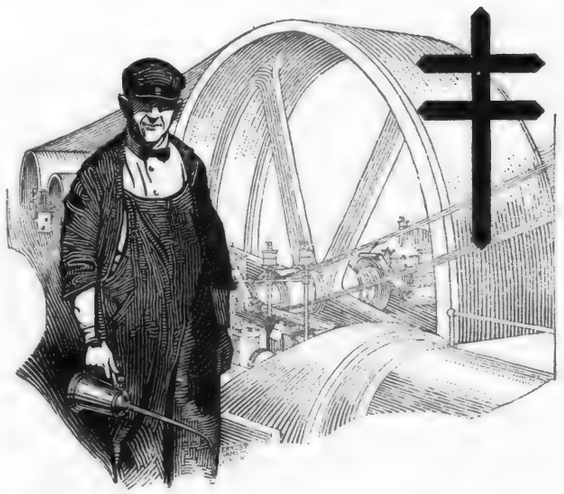

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What oil is to the machine, health is to the worker. The efficiency of both is essential to good business.

An average of 2½ years of productivity would be added to the life of every individual who reaches the age of 17, if there were no fatal cases of tuberculosis. The economic loss to America due to tuberculosis is more than $500,000,000 annually.

It is your responsibility to combat this human and economic waste.

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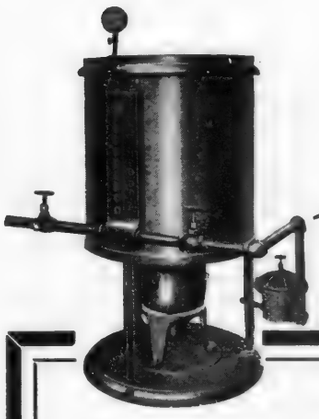

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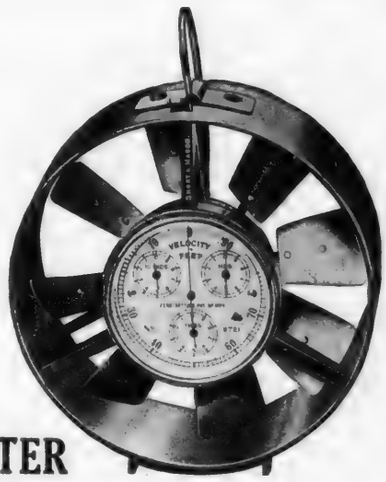

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accurately measures the air in velocities 100 to 3000 feet per minute. Made like a watch — jeweled bearings. Calibration charts furnished, correct for all readings.

Easy to Carry About

Compact—easy to handle. Threaded socket permits readings in otherwise inaccessible places.

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There's a *Tycos* or *Taylor* Temperature Instrument for every purpose

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Copper Boilers

Let us figure on your requirements

DAHLQUIST MFG. CO.

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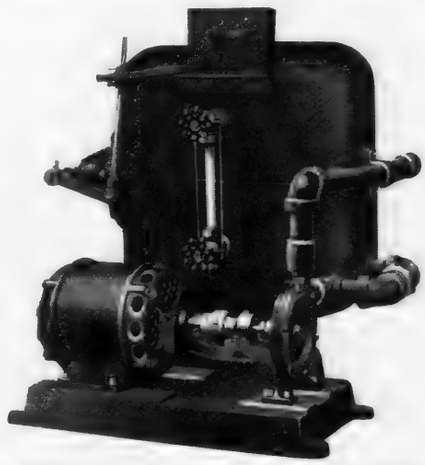

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A single stage pump suitable for high or low pressure ranging from 10 lbs. to 100 lbs.

The unit is very compact, mounted on cast iron base, only two pipe connections necessary when installing. The receiver is made in two sizes, of heavy cast iron. An enclosed butt contact switch is used on all pumps.

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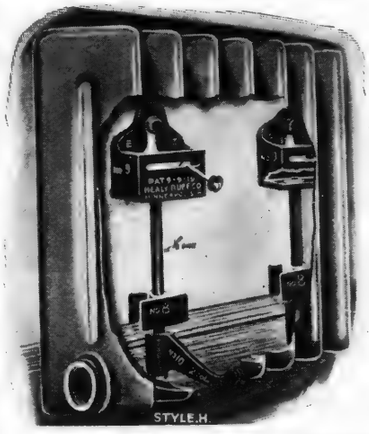

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ONE BOLT IN THE WALL

Both styles made for Wall and Column Radiation.

Very Reasonable in Price.

Agents in a good many Cities

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MINNEAPOLIS, MINN.

FOR UNDERGROUND STEAM OR HOT WATER PIPES

THE EFFICIENT

RIC-WIL METHOD

means the practical elimination of heat losses. RIC-WIL installations commonly show efficiencies of 85% —there are cases where it has shown better than 90%. And not for a week or a month, but continuously, and after years of service. This means just one thing—economy—conservation of the coal pile. Economy is the *only* reason why underground pipes are insulated at all: it is the *best* reason why they should be insulated by the RIC-WIL METHOD.

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Offset corner with male union

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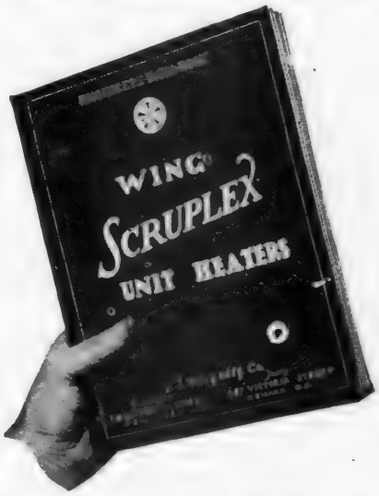

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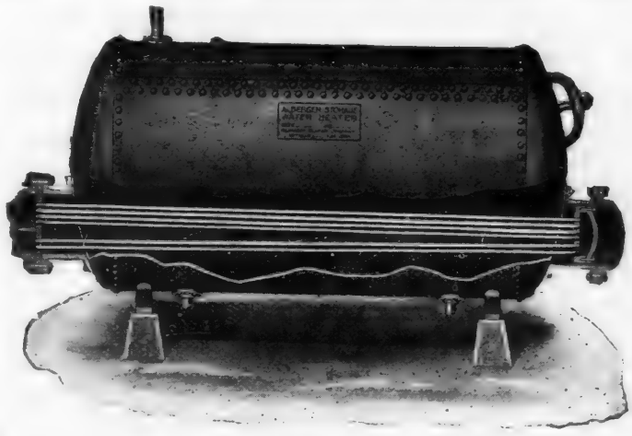

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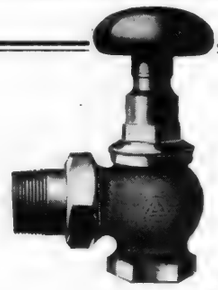

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So well do these valves qualify for efficient service—for handsome design and pleasing appearance—for complete satisfaction, that leading architects, heating engineers and master builders, the country over, recommend and specify them for jobs that require the most careful consideration.

They are made for steam, vapor and vacuum heating systems—in all necessary sizes and a variety of styles. Let us send booklet giving full information.

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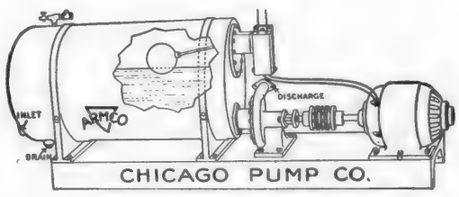

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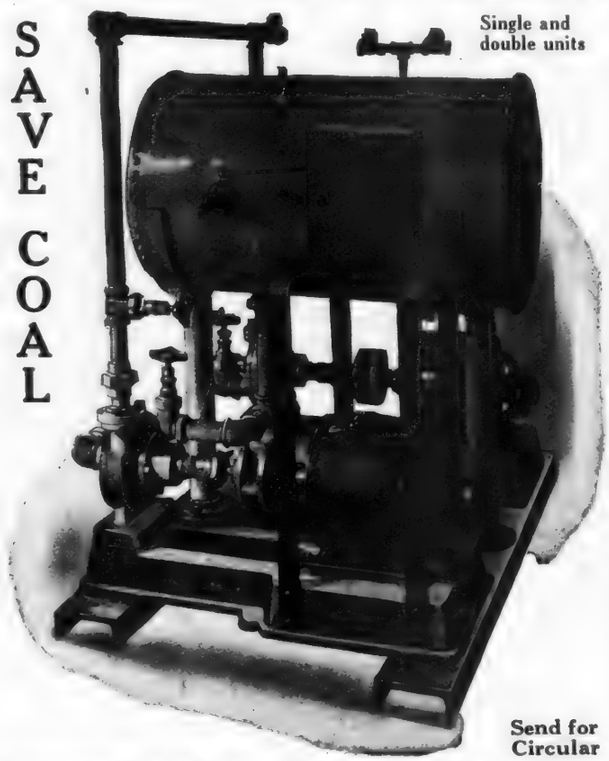

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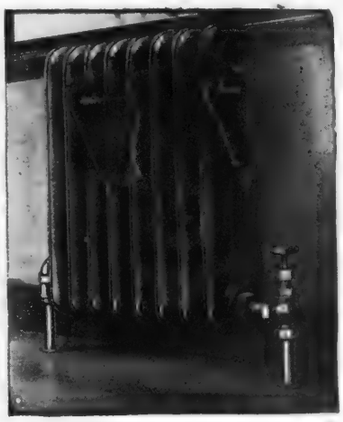

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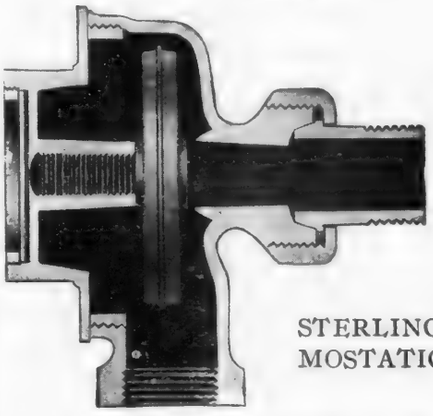
985 Dean St., Brooklyn, N. Y.

STERLING SYSTEMS



STERLING THERMOSTATIC TRAP

The Sterling Thermostatic Trap is steam tight, yet will free the unit of air and water.

Note the vertical self cleaning seat.

Diaphragm closes against the steam, not with it.

We also manufacture
Return Traps—Air Line Valves—Graduated Supply Valves
—Air Eliminators—Damper Regulators—Strainers

STERLING ENGINEERING COMPANY
Milwaukee Wisconsin

$5,000,000,000
Available for Productive Enterprises

in three years if the thirty million workers of the country would save an extra dollar a week.

Billions of New Capital is literally the Need of the Hour.

In our onward march it becomes more and more imperative that new sources of capital be explored, that new classes of investors be developed.

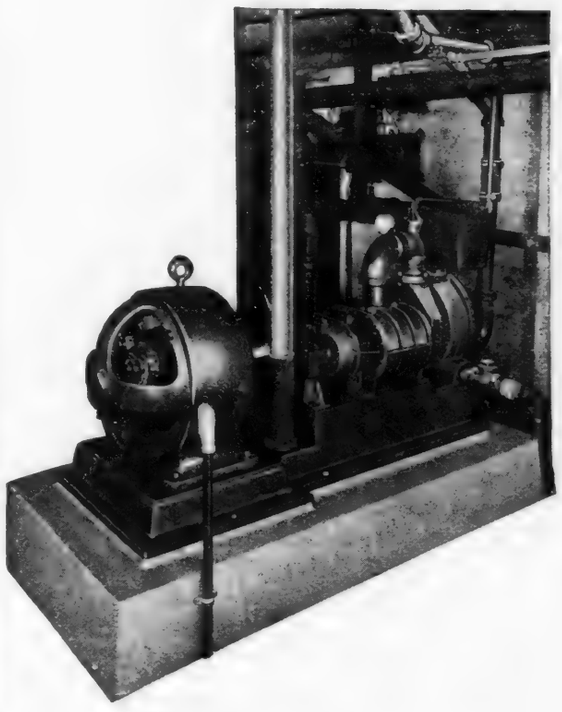
A Government Savings Association organized in your establishment will make it possible for your employees to do their part in the great work of reconstruction.

Write for the Treasury Department's Standardized Industrial Savings Plan which makes it easy for workers to save and invest in

TREASURY SAVINGS SECURITIES
25c to $1000

Government Loan Organization
Second Federal Reserve District
120 Broadway New York City

CONNERSVILLE
VACUUM CLEANING SYSTEMS



Automatic Disposal of All Dust and Dirt

This feature eliminates the shutting down of the machine for the cleaning out of dust tanks or buckets as the dirt is discharged continuously into the sewer in a liquid condition direct from the separator.

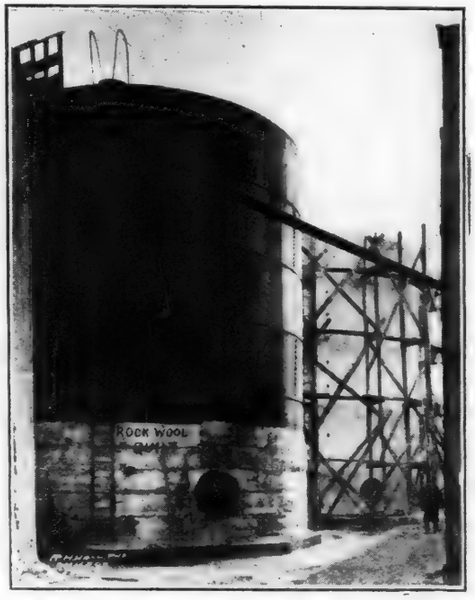
The Connersville system can be used, not only for regular cleaning, but can be used for the cleaning of swimming pools.

The unit is compact and easy to install, as the motor, pump and separator are all mounted on the same cast iron base.

There's a Connersville machine for every cleaning problem.

SEE OUR CATALOGUE IN SWEET'S

LANDERS, FRARY & CLARK
U. V. A. Div. Dept. C. CONNERSVILLE, IND.



High Temperature Steel Tanks

RELIABILITY

of

Banner Rock WOOL Quilt

100% Fireproof

HEAT INSULATION

Just place Banner Rock Wool Quilt on any hot surface, according to simple directions, plaster it and forget it is there.

Results will be clearly shown in your coal pile which will at once start paying dividends — more dividends than any other insulation can produce.

It takes but little trouble and a two cent stamp to find out all about this material, and you will doubtless find out, as have many others, it is time and money well spent.

Write Now to

BANNER ROCK PRODUCTS CO.

Manufacturers of

HEAT AND COLD INSULATION

ALEXANDRIA INDIANA

"Wainwright" Service Heaters

Built in Vertical or Horizontal Patterns— Temperature Control Furnished if Desired

Ask for Bulletin

Consult Our Engineering Department

ALBERGER PUMP & CONDENSER CO.

140 Cedar Street, New York

Boston Chicago St. Louis Philadelphia

P **Preferred by those who recognize true merit in a water Heating System**

A Automatic, requiring no adjustment — and no attention whatever

T Temperature is uniform under all variations of service

T Time is saved by having an unlimited supply of scalding **hot water**

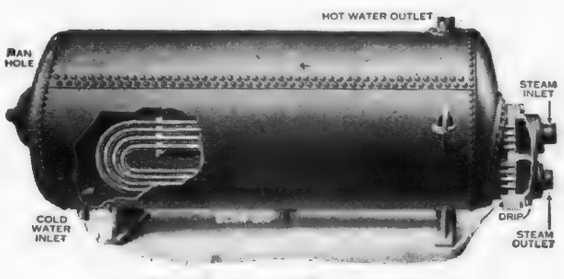
E Efficient and economical. Materials and workmanship unexcelled

R Reliable with nothing to get out of order and cause trouble and delay

S Steam may be either exhaust, high or low pressure live steam

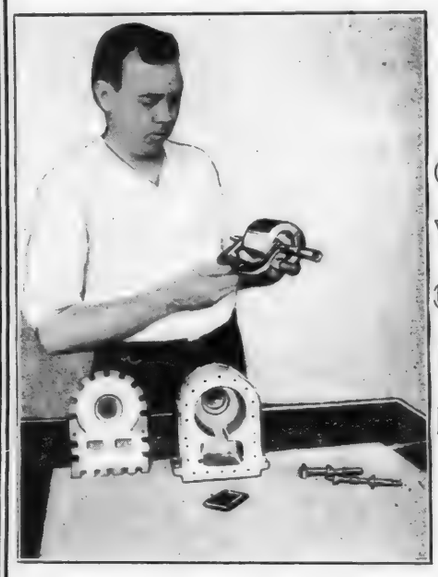
O Operating cost is next to nothing no difference how long in use

N Noted for supplying **Hot Water** for domestic or industrial purposes



The Patterson System of Water Heating for any Service

Patterson-Kelly Co.
23 Dey St. New York



One Way to Celebrate Labor Day

A Positive Demonstration

THE PICTURE ABOVE SHOWS how Mr. Thompson spent labor day—in the laboratory, dismantling and inspecting a test pump which has been in continuous operation since last April.

This pump has run 3360 hours without the slightest attention. The trip mechanism has operated 56,000 times—equivalent to more than two years of actual service. The water has averaged 185 degrees Fahrenheit.

The impeller shows a wear of .0005 inches. The end plate was worn less than .001 inches The hinge cutoff showed no sign of wear. The ball bearings were in perfect condition. The reversing valves showed no wear—their seats retaining the original high polish.

Here is a conclusive demonstration of the wearing of this improved return line pump--a showing that makes ten years of ordinary service a conservative estimate.

INVESTIGATE---

Thompson's Du Moin Vacuum Return Line Pump

Write for Bulletin No. 5 with full particulars of the new principle which increases the life of the pump, cuts repair bills and reduces the power bills one half.

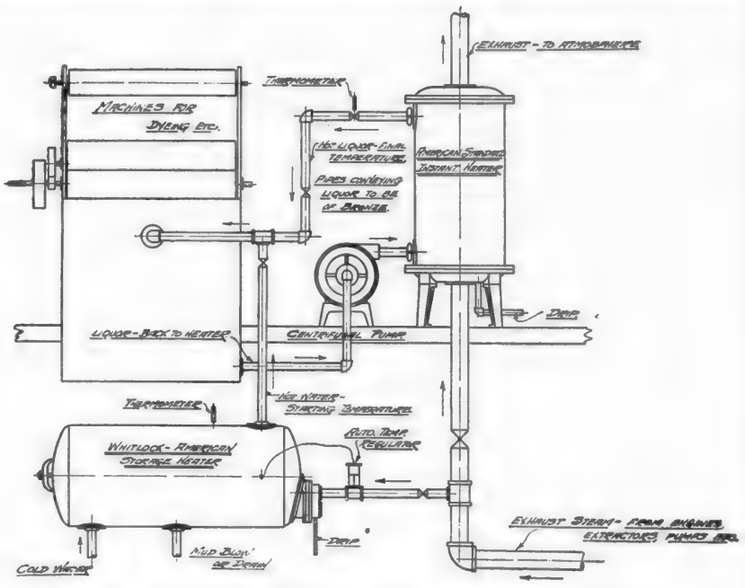
THOMPSON MANUFACTURING CO.
813 24th St. Des Moines, Iowa.

WHITLOCK Industrial Heaters

Built in types and sizes for every industrial need.

Now operating in power plants, mills, factories, laundries, dairies, hotels, schools and office buildings.

Write for complete descriptive catalog



This illustration shows a typical WHITLOCK HEATER installation applied to a dye house

THE WHITLOCK COIL PIPE COMPANY, Hartford, Conn.

New York Chicago Boston Philadelphia Buffalo

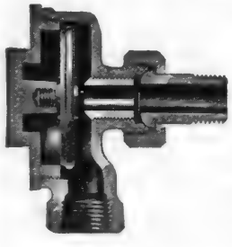
"Whitlock Heaters have Everlasting Copper Tubes"

HEATING IDEAL EQUIPMENT TRADE MARK

IDEAL TRAPS

Make Vapor and Vacuum Heating Systems

Efficient and Economical

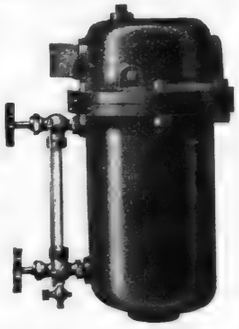


The Ideal Thermostatic Radiator Trap

Is built for long, hard service. Its rugged diaphragm withstands corrosive elements and excessive pressures. A reliable trap unaffected by sediment or scale.

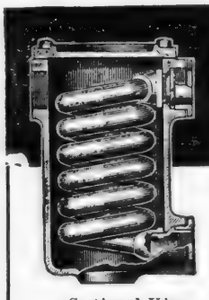
The Ideal Alternate Return Trap

Assures a steady water line by returning condensation to the boiler against pressure. Freely removes all air, and makes vapor heating safe.



Ideal Heating Equipment Co.

1897 E. 90th St., Cleveland, Ohio.



HOT WATER AT LOWEST POSSIBLE COST

Sectional View

ORDER YOUR EXCELSO HEATER WITH OTHER HEATING EQUIPMENT

Endorsed and Sold by

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Richardson & Boynton Co.
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Gurney Heating Mfg. Co.
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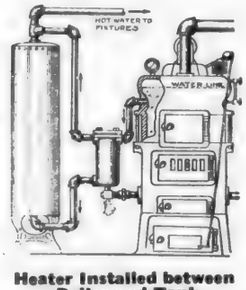

Heater Installed between Boiler and Tank

Also by plumbing and heating jobbers Everywhere

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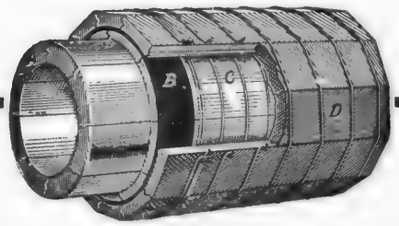
Excelso Specialty Works, 117 Clinton St., Buffalo, N.Y.



A—Inner Shell, 2 inches thick.
B—Asphaltum Packing.
C—Dead Air Space.
D—Outer Shell, 1 inch thick.

Cover Your Steam Pipes with

Wyckoff's
Improved
Cypress Covering

Not affected by wet and dry conditions common to steam-pipe trenches. Will not rot. Absolutely water and steam tight. Each shell is wound with extra-heavy steel wire. Coated all over with the best known preservative—**Montezuma Asphalt.**

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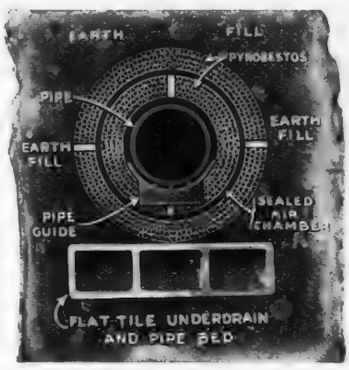
A. WYCKOFF & SON CO.
ELMIRA, N. Y.

PYRO-BESTOS



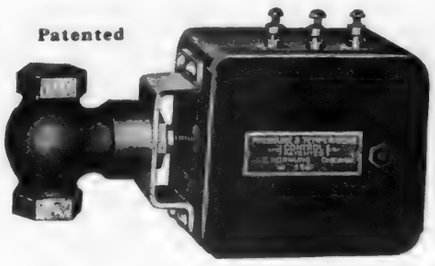
Underground Pipe Insulation

For piping from central heating plants or power stations to detached buildings of Universities, Asylums, Hospitals, Factories, etc. Also an underground Pipe Conduit for heating private Auto Garages direct from House heating systems

Cannot rot or decay nor will it retain moisture to rust and destroy the piping during non-heating season.

Saves most coal, sends dry steam to a greater distance and by reason of its advanced common sense method of installation is at the same time a lower cost per foot of pipe covered than any other Underground Pipe Insulation on the market.

National Asbestos Mfg. Co.
163-193 Henderson Street, Jersey City, N. J.



The HORNUNG Magnetic Valve

This is the little valve used as a pilot on all sizes of HORNUNG PRESSURE and TEMPERATURE CONTROL VALVES. It has many other uses.

Ask for Catalogue No. 14

CENTRAL HEAT APPLIANCES
J. C. HORNUNG
343 South Dearborn St. Chicago

Better Than Ratchet Handle

THIS "Toledo" Power Drive for geared hand threaders and cutters is connected or disconnected just the same and just as easily as ratchet handle, yet it operates pipe tools five times faster than by hand. Write us for circular and catalog "F".

The Toledo Pipe Threading Machine Co.
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New York Office:
50 Church St., New York City

TOLEDO DRIVE
PORTABLE POWER

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Carrier Engineering Corporation, New York.
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New York Blower Co., Chicago, Ill.
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Plant Engineering & Equipment Co., New York.
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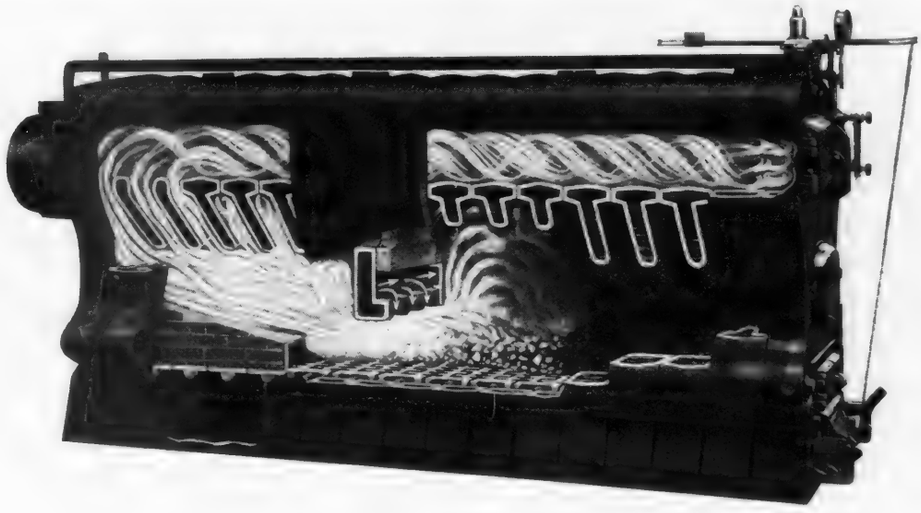
Wright-Austin Co., Detroit, Mich.

Cross Section of the Super-Smokeless Boiler



Arrows Indicate Current of Fresh Air to the Flame

Save Coal With This Boiler

An Imperial Super-Smokeless Boiler, installed in the Imperial Theatre in Philadelphia, saved over 63% on the previous year's coal bill despite much colder weather.

This is typical of the efficiency of these boilers with their scientific design. The Bunsen Burner Idea of admitting more air (oxygen) to the flame, gives an intense heat which burns up smoke and all combustible gases, assuring remarkable steam capacity from the cheaper grades of soft coal.

Investigate this fuel-saving, smokeless boiler. Complete description and list of many installations sent upon request.

UTICA HEATER COMPANY

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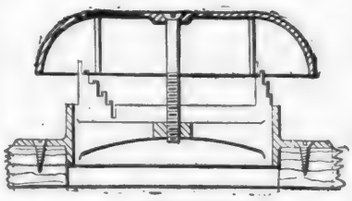

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Simmons Co., John, New York.
The Wm. Powell Co., Cincinnati, O.
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Atlas Valve Co., Newark, N. J.
Crane Co., Chicago, Ill.
Non-Return.
Crane Co., Chicago, Ill.
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Illinois Engineering Co., Chicago, Ill.
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Crane Co , Chicago, Ill.
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Dole Valve Co., Chicago, Ill.
Dunham Co., C. A., Chicago, Ill.
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McAlear Mfg. Co., Chicago, Ill.
McDonald Under-Seat Valve Co., Cleveland, O.
Marsh Co., Jas. P., Chicago, Ill.
Marsh Valve Co., Erie, Pa.
Simmons Co., John, New York.
Sterling Engineering Co., Milwaukee, Wis.
The Wm. Powell Co., Cincinnati, O.
Trane Co., La Crosse, Wis.
Webster & Co., Warren, Camden, N. J.
Reducing.
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Dunham Co., C. A., Chicago, Ill.
Fulton Co., Knoxville, Tenn.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.
Johnson Service Co., Milwaukee, Wis.
Kennedy Valve Mfg. Co., Elmira, N. Y.
McAlear Mfg. Co., Chicago, Ill.
Mason Regulator Co., Boston, Mass.
Powers Regulator Co., Chicago, Ill.
The Wm. Powell Co., Cincinnatti, O.
Regulating.
American District Steam Co., No. Tonawanda, N. Y.
Atlas Valve Co., Newark, N. J.
Fulton Co., Knoxville, Tenn.
Hornung, J. C., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.
McAlear Mfg. Co., Chicago, Ill.
Plant Engineering & Equipment Co., New York.
The Wm. Powell Co., Cincinnati, O.
Safety.
American District Steam Co., No. Tonawanda, N. Y.
Jenkins Bros., New York.
The Wm. Powell Co., Cincinnati, O.
Stop and Check (See Valves, Non-Return.)

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American Radiator Co., Chicago, Ill.
Bayley Mfg. Co., Milwaukee, Wis.
Buffalo Forge Co., Buffalo, N. Y.
Clarage Fan Co., Kalamazoo, Mich.
Hersh Bros. Co., Allentown, Pa.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Massachusetts Blower Co., Watertown, Mass.

Ventilating Systems.
American Blower Co., Detroit, Mich.
Atmospheric Conditioning Corp., Phila., Pa.
Autovent Fan & Blower Co., Chicago, Ill.
Buffalo Forge Co. Buffalo, N. Y.
Carrier Engineering Corporation, New York.
W. L. Fleisher Co., New York, N. Y.
Hackney Mfg. Co., St. Paul, Minn.
Hersh Bros. Co., Allentown, Pa.
Ilg Electric Ventilating Co., Chicago, Ill.
Massachusetts Blower Co., Watertown, Mass.
Moline Heat, Moline, Ill.
New York Blower Co., Chicago, Ill.
Skinner Bros. Mfg. Co., St. Louis, Mo.
Sprague Electric Works, New York
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
L. J. Wing Mfg. Co., New York.

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Buckeye Blower Co., Columbus, O.
Hersh Bros. Co., Allentown, Pa.
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New York Blower Co., Chicago, Ill.
Stark Sheet Metal Works Co., Canton, O.
Sturtevant Co., B. F., Hyde Park, Boston, Mass,
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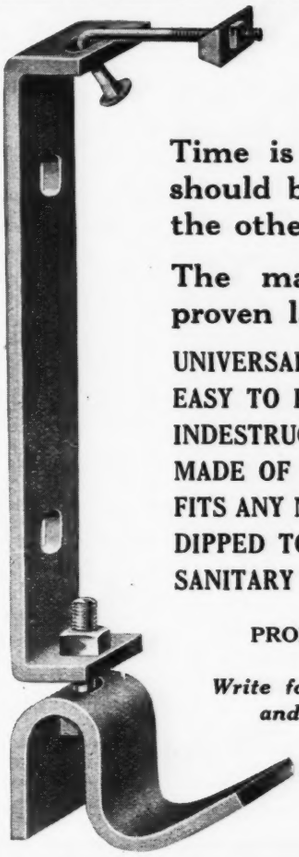

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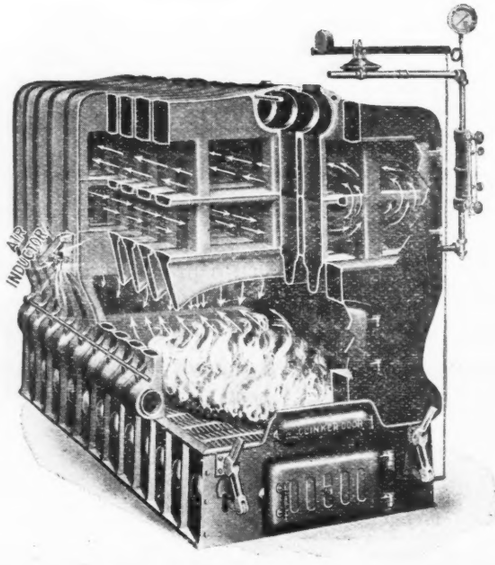

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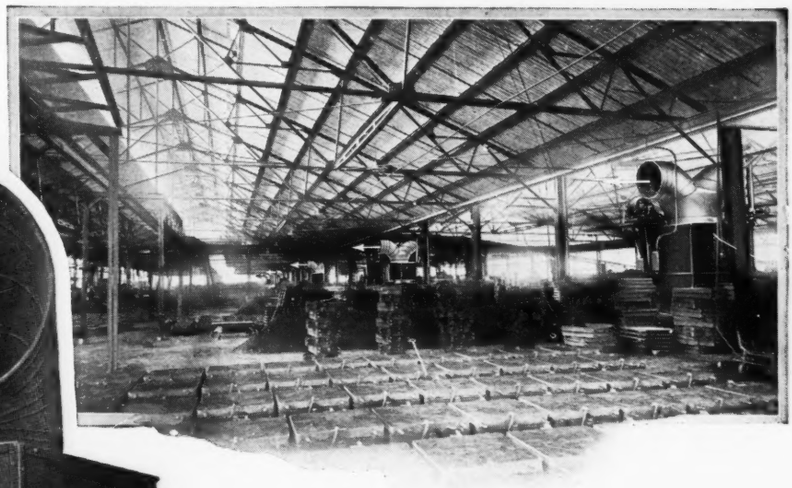

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